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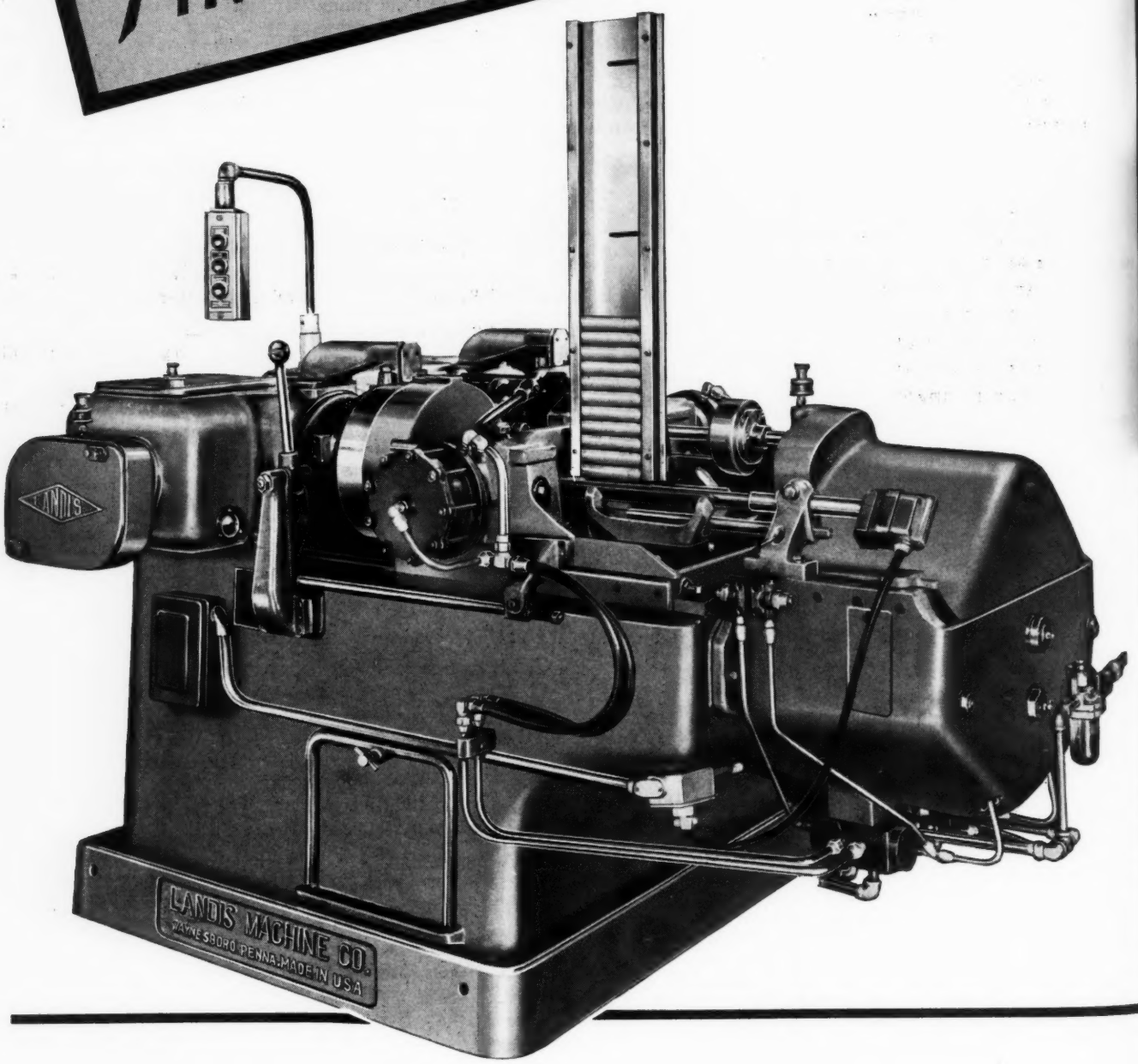
THREADS, ON



THE WORLD'S LARGEST EXCLUSIVE MANUFACTURERS

MACHINERY
OCTOBER, 1948
Vol. 55 No. 2

Turning Irregular Contours on a Lathe

By ROBERT MAXANT
Maxant Button & Supply Co.
Chicago, Ill.

UP to about twenty years ago, form-turning of punches, molds, or dies on a lathe required careful manipulation of longitudinal and transverse feeds in order to generate the desired contour. Even with skilled operators and inspection templets, the results were sometimes inaccurate and generally inconsistent. In other cases, expensive form tools, ground to the necessary dimensions, were required. Naturally, the cost of making many dies or molds was prohibitive.

These problems led to the development of the Monarch-Keller automatic form-turning machine, with which it is possible to turn or bore a work-piece of circular cross-section to any predetermined longitudinal contour from a thin sheet-metal templet. In operation, as shown in Fig. 1, the single-point tool is guided along the work by means of an electric tracer. The tracer engages a templet of the same contour as that to be produced on the work-piece. Alternate longitudinal and cross feeds, in increments of 0.001 inch, are automatically secured from magnet clutches driving the carriage and cross-slide of the lathe, as described in detail in July, 1948, MACHINERY, page 194.

Since the machine, as originally designed, was limited to producing contours on parts of round cross-section, various developments followed to extend its range of application. An

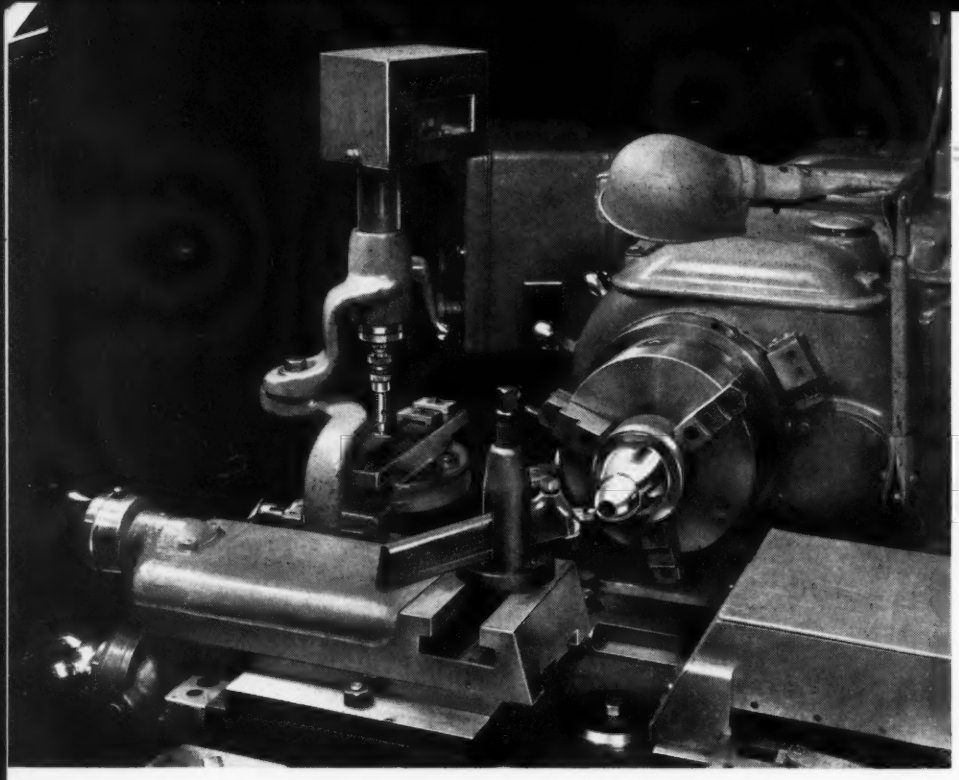


Fig. 1. Automatic Form-turning Operation in which a Single-point Tool is Guided along the Work by an Electric Tracer which Engages a Templet of Desired Contour

oval chuck was designed to permit turning ellipses in conjunction with other contours. Specially built machines were evolved for machining work having a surface varying in distance transversely from its axis of rotation. A cam-driven oscillating tool-slide was employed to move the tool toward or away from the work as the work revolved, thus duplicating the shape of the cam on the work.

Another important development was a pantograph type of compensating mechanism, called a "centrode" device, by means of which the stroke of the cutting tool can be varied from the stroke imparted by the cam to its follower. This permits the same cam to be used for parts of various diameters, while still retaining the original contour. Used in conjunction with the Keller automatic form-turning controls, this device makes it possible to machine contours with limited radii in a geometrical pattern. The cross-section of the part can be oval, triangular, square, hexagon, octagon, or any other shape

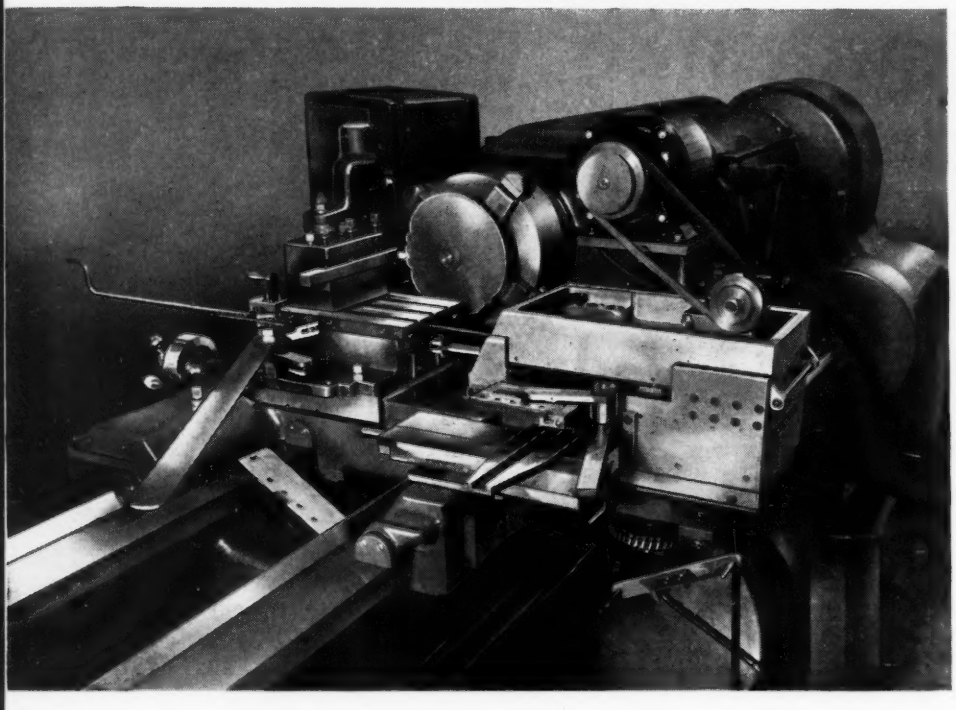


Fig. 2. A Developed Templet is Mounted on the Spindle-nose Adapter of the Lathe and a Milling Head is Substituted for the Cam Follower on the Shapemaster Mechanism to Mill a Blank Record

having a maximum radius variation of 2 1/2 inches. As many as 520 flat, concave, or convex flutes can be produced around the periphery, in the bore, or on the face of the part.

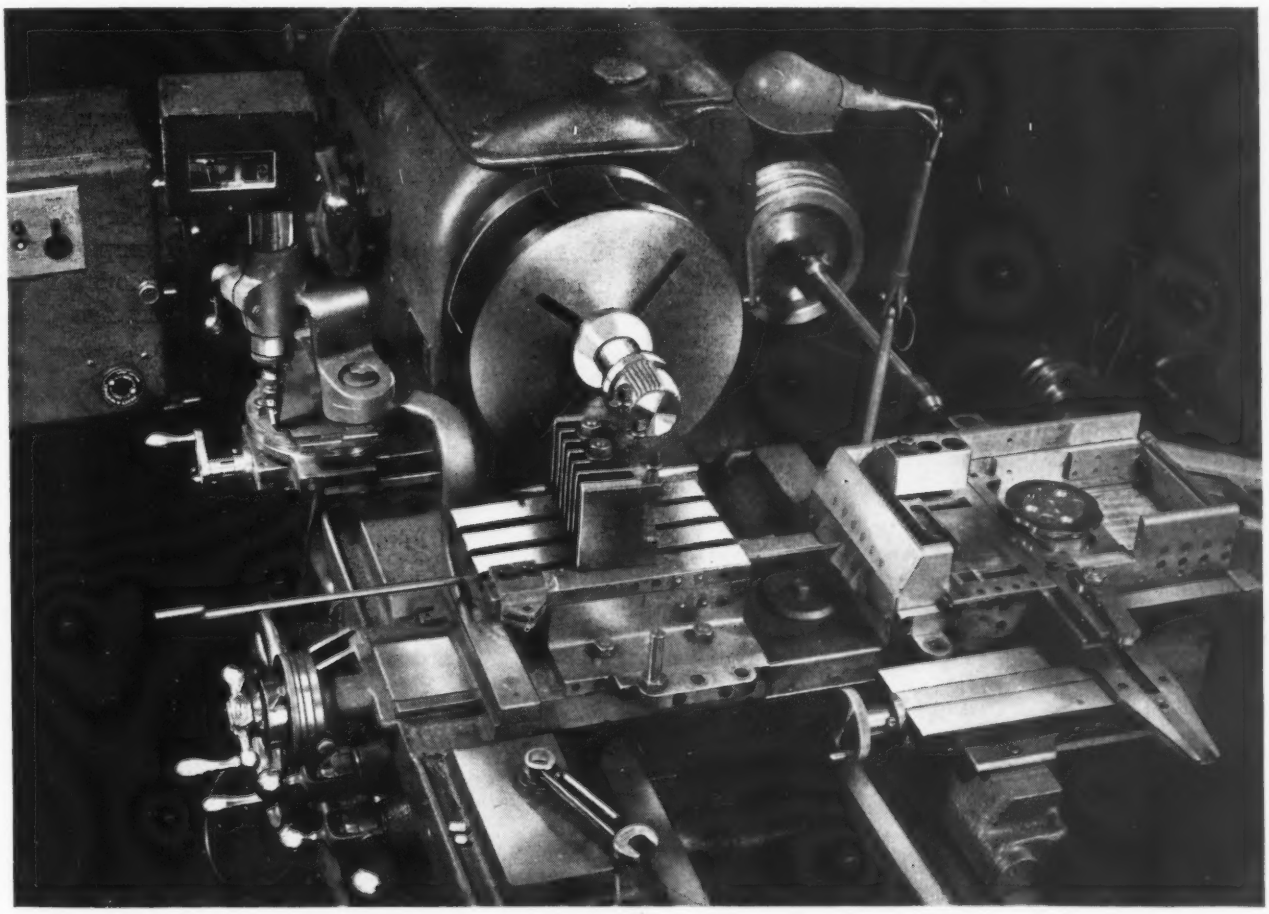
This series of developments led to the design of the Shapemaster lathe by the Monarch Machine Tool Co., Sidney, Ohio. This lathe enables various types of multi-sided shapes to be turned, bored, and faced to practically any contour that permits entry of the tool into the cut. Contours can be turned in either the vertical or horizontal plane, or in both planes simultaneously. Cross-sectional shapes can be machined with changing contours, as in blending the flat body portion to the round neck section of a mold for square or flat bottles.

The Shapemaster mechanism consists of three elements—one for controlling the shape cut, another for regulating the rate of repetition or number of irregular shapes produced on any given circumference, and a third for controlling the contour generated on successive diameters.

The first element—for controlling the shape—is a cam-operated tool-actuating device mounted on the carriage cross-slide in place of the usual compound rest. A follower, actuated by a master cam (or record) which rotates on a spindle at the rear of the cross-slide, is linked to the movable tool-holder. The tool-holder reciprocates on anti-friction bearings, guiding the tool in a shaper-like stroke, which is adjustable from 0 to 2 1/2 inches.

The master record, which is actually a plate cam, generally includes only a single unit of the desired pattern—oval, triangular, square, hexagonal, or other shape. Repetition of the shape to be cut is determined by the ratio of speed between the record (cam) and the spindle (work). A single motor drives both record and spindle through a gear train. By means of

Fig. 3. A Work-piece Replaces the Templet, and a Tool Bit is Substituted for the Templet Follower for Contour Turning



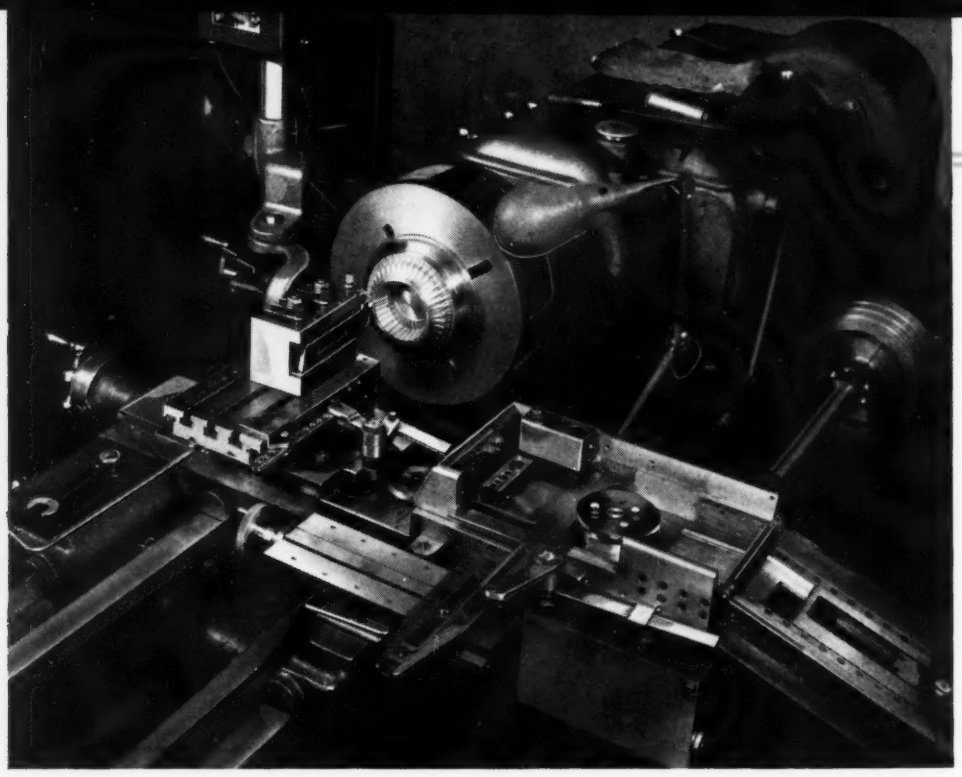


Fig. 4. After the Outside Diameters of the Work have been Turned to the Desired Contour, as Shown in Fig. 3, the Tool-slide is Rotated through an Angle of 90 Degrees to Bring the Tool into Position for Contouring the Face of the Work

change-gears, from 1 to 520 tool strokes can be obtained for one revolution of the work. The desired shape can be reproduced on different diameters of the same work-piece with only one record by adjusting the device.

Helical contours can be obtained by using odd gear ratios. For example, instead of a 15 to 1 ratio, a 14.998 or 15.002 to 1 ratio would be used. On certain work having a substantial rounded corner between the outside diameter or bore and the face, it is possible to turn, or bore, and face in one continuous operation by setting the tool at an angle of 45 degrees with the axis of the work.

Master records are made directly on the Shapemaster lathe. It is first necessary to develop a templet having a single unit of the desired pattern for symmetrical work or the complete pattern for unsymmetrical pieces. The templets are generally made from mild sheet-steel blanks, 16-gage (0.065 inch thick) and not more than 8 inches in diameter. A hole is drilled in the center of the blank to fit the spindle-nose adapter on the lathe.

Angular lines bounding one segment of the repetitive pattern on symmetrical parts are scribed on one face of the blank. The desired contour is then filed, milled, sawed, or shaped along the scribed arc on the periphery of the blank. An optical comparator is employed to inspect precise shapes. The dimensions of the developed shape need not be the same as those

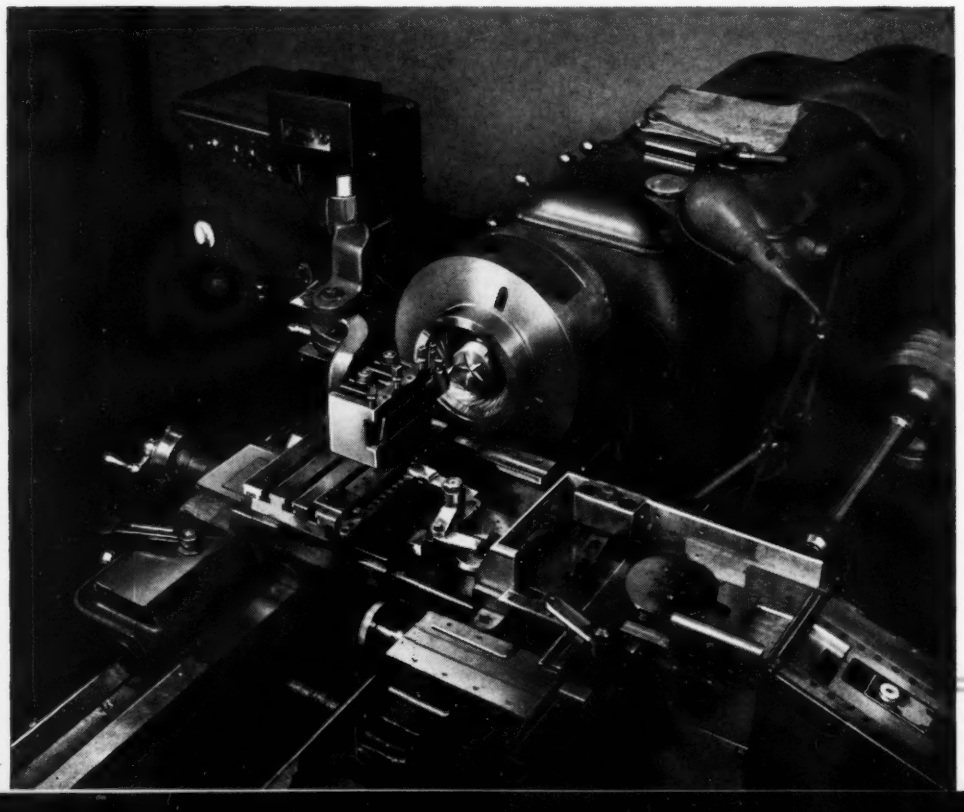


Fig. 5. Completion of the Face-contouring Operation, the Set-up for which is Shown in Fig. 4

Fig. 6. A Tapered Part of Square Cross-section is Shown being Turned on a Shapemaster Lathe. The Square Bore was Also Machined on a Taper in a Similar Set-up

desired on the work-piece; in fact, they are usually increased to obtain greater accuracy, since differences can be adjusted by the compensating device previously mentioned. Smaller or larger parts having the same contour can be reproduced from one master record by adjusting the pantograph linkages. Also, many shapes can be obtained from the same record by changing the gear ratio, which changes the relative speeds of record and work.

The completed templet is mounted on the spindle-nose adapter of the lathe, and a wedge-shaped templet follower is placed in the tool-holder, as shown in Fig. 2. The follower is spring-loaded to keep it in contact with the flat templet. A record blank—generally a Meehanite casting, 8 inches in diameter by 1/4 inch thick—is placed on a vertical shaft in the Shapemaster housing on the rear of the cross-slide. A motor-driven milling head (upper right) is then substituted for the cam follower, with the milling cutter in contact with the periphery of the record blank.

The record and templet are rotated simultaneously by a hand-crank (seen at the lower right). For symmetrical parts, the record is geared to revolve faster than the templet, in the ratio of the number of repetitive patterns desired to one. In this way, one pattern is created around the entire periphery of the record. For unsymmetrical parts, it is necessary to rotate the record and templet at the same speed. The record is brought toward the rotating milling cutter by moving the cross-slide manually until the entire periphery of the record has been machined.

The milling attachment can then be removed and the spring-loaded cam follower roll placed in contact with the completed record. The templet is replaced by the raw material to be cut, and a high-speed steel tool bit is substituted for the templet follower (Fig. 3). Care must be taken in grinding the tool bit to provide sufficient clearance to avoid all the contours to be produced on the work.

With the compensating arm of the centrode device set at zero, so that the tool will not reciprocate to form a contour, trial cuts are made by advancing the tool manually until the desired over-all diameter of the work is obtained. The compensating arm of the pantograph arrangement is then set by means of a scale on the carriage adjacent to the cross-slide to give the desired depth of cut or reciprocation. This setting takes care of any difference between the diameter of the master record and the diameter of the part being machined.

After completely turning the outside contour of the work or boring the inner contour, the tool-slide is rotated through an angle of 90 degrees, so that the slide and tool bit will be parallel with the axis of the spindle and work (Fig. 4). The face of the part is then contoured, as shown in Fig. 5. A link on the compensating arm can be set to decrease the depth of cut progressively toward the center of the work for fade-out contours, or the depth of cut can be kept the same. In the latter case, however, the

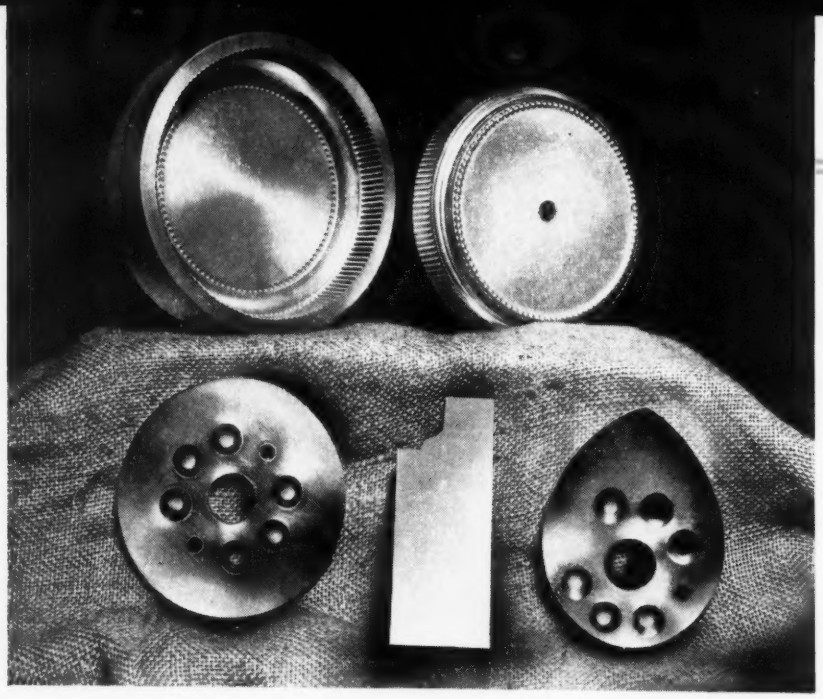


Fig. 7. A Lamp Base (Upper Right) Produced from the Mold Shown at the Upper Left. Master Records and the Templet Employed to Machine the Mold are Shown Below

Fig. 8. (Below) These Molds, Used for Eyeglass Lenses, were Machined on a Shapemaster Lathe

Fig. 9. (Above) Molds. Bottom Plate, and Plunger Produced on a Shapemaster Lathe for Making the Glass Dish Portion of an Ash Tray

angles formed by the sides of the contour will progressively increase toward the center of the part, and it is seldom possible to feed the tool all the way to the center of the work.

Surface speeds generally must be kept low, since the master record usually rotates many times faster than the work and difficulty is experienced in keeping the cam follower roll in contact with the master record if the speed of the record is too high. For the part shown, a spindle speed of 30 R.P.M., corresponding to a surface speed of 30 feet per minute, was employed. With the gear ratio required, the master record was rotated at 45 R.P.M. Three roughing cuts were taken, with a 0.040-inch depth for each cut and a feed of 0.015 inch per revolution. One finishing cut, 0.005 inch deep with a feed of 0.003 inch per revolution, was employed.

As previously mentioned, the same shape can be produced over a constantly increasing or decreasing diameter of the work-piece without changing the master record, by means of the stroke-compensating device. Also, irregular contours can be obtained by using a flat sheet-metal templet when the Shapemaster is equipped with a Keller form-turning attachment.

By using both the Shapemaster mechanism and Keller attachment simultaneously, a contour can be produced on steep tapers, as required in making molds for irregular-shaped and fluted perfume or beverage bottles and barrels for automatic pencils. A tapered part of square cross-section is shown being machined in Fig. 6 and in the heading illustration. The square was also bored on a taper in a similar set-up.

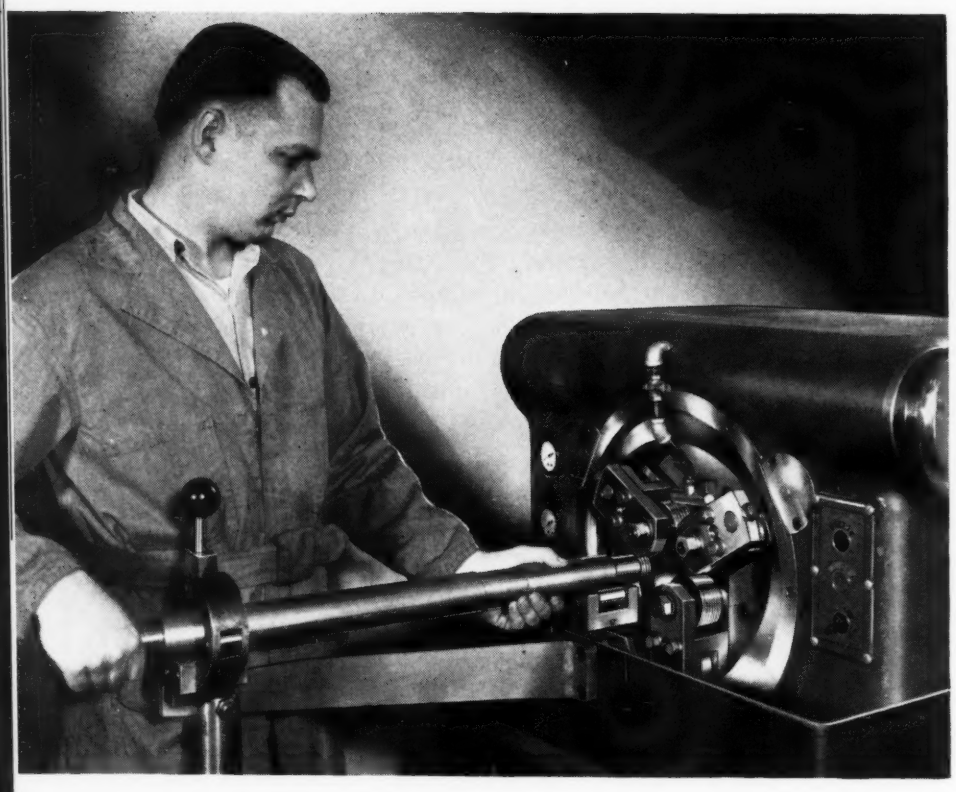
A lamp-base mold and the lamp base produced with it are shown at the top left and right, respectively, in Fig. 7. At the bottom are shown the two records used with the Shapemaster mechanism and the sheet-metal templet employed on the Keller attachment for producing the mold. Molds for eye-glass lenses made by the American Optical Co. (illustrated in Fig. 8) were produced on the Shapemaster lathe. Another example of parts made on this machine, including the molds, bottom plate, and plunger for making the glass dish portion of an ash tray, is seen in Fig. 9.

Broaching Molds for Rubber Gears

IN the manufacture of molded rubber gears, the mold life is comparatively short, and when production runs are high, the molds require constant replacement. When the mold here shown was originally produced, the blank was laid out as accurately as possible by using a punch, scriber, index-plates, and special curves. The blank was then slotted, milled, or machined on a Keller tool-room machine and a hardened male punch was driven through it. Proper clearances were obtained by hand-filing and polishing. As this manufacturing process was expensive, broaching was substituted. With this method, the blank is bored to receive the pilot end of a roughing broach. Then, in two passes with roughing and finishing broaches, the mold is machined, ready for heat-treatment. Molds are duplicated within plus or minus 0.0001 inch. Thirty-two duplicate molds have been produced by this method at a substantial saving. The broaches were made by National Broach & Machine Co., Detroit, Mich.

Mold for a Rubber Gear Produced by a Broaching Operation at a Large Saving in Cost over the Method that was Previously Employed

High-Production Rolling



Threading, Burnishing, Knurling, or Serrating of Solid Bars and Hollow Tubes up to 1½ Inches in Diameter Can be Performed in a New Hydraulic Thread-Rolling Machine at Rates of from 500 to 1000 Pieces per Hour

THERE are many advantages inherent in the thread-rolling process. Some of these may be summarized as follows: The thread strength and surface hardness produced are high because of the forging nature of the operation and the amount of cold work performed on the part; machines can be tooled for either manual or automatic operation; various sizes of work can be handled; and long tool life can be obtained. However, the principal advantage lies in the fact that a precision form can be rolled on a part, usually in a matter of seconds.

Special emphasis is placed on precision, speed, and ease of operation in the new thread- and form-rolling machines recently developed by the National Acme Co., Cleveland, Ohio. As a result, operating features usually not found in machines of this type have been incorporated into the design. These machines can be used to roll National fine, National coarse, square, Acme, or ball-bearing type threads on plain carbon steel; high-carbon, high-chromium alloy steel; high-speed steel; brass; aluminum; and bronze. In addition, knurling, burnishing, serrating, and other form-rolling operations can be accomplished, as illustrated by the parts shown in Fig. 1. Short pieces can be rolled to a shoulder or long bars—both hollow and solid—can be fed through the rolls and out the back of the machine.

Construction of the Thread-Rolling Machine

The machine accommodates four work-heads that collectively cover a work range of from 1/8 inch to 1 1/2 inches in diameter. Three of these are three-roll heads having capacities ranging from 3/8 to 9/16 inch, 9/16 to 1 inch, and 1 to 1 1/2 inches in diameter; one is a two-roll unit for work from 1/8 to 9/16 inch in diameter. Each head is a complete assembly that can be installed in or removed from the machine in approximately fifteen minutes.

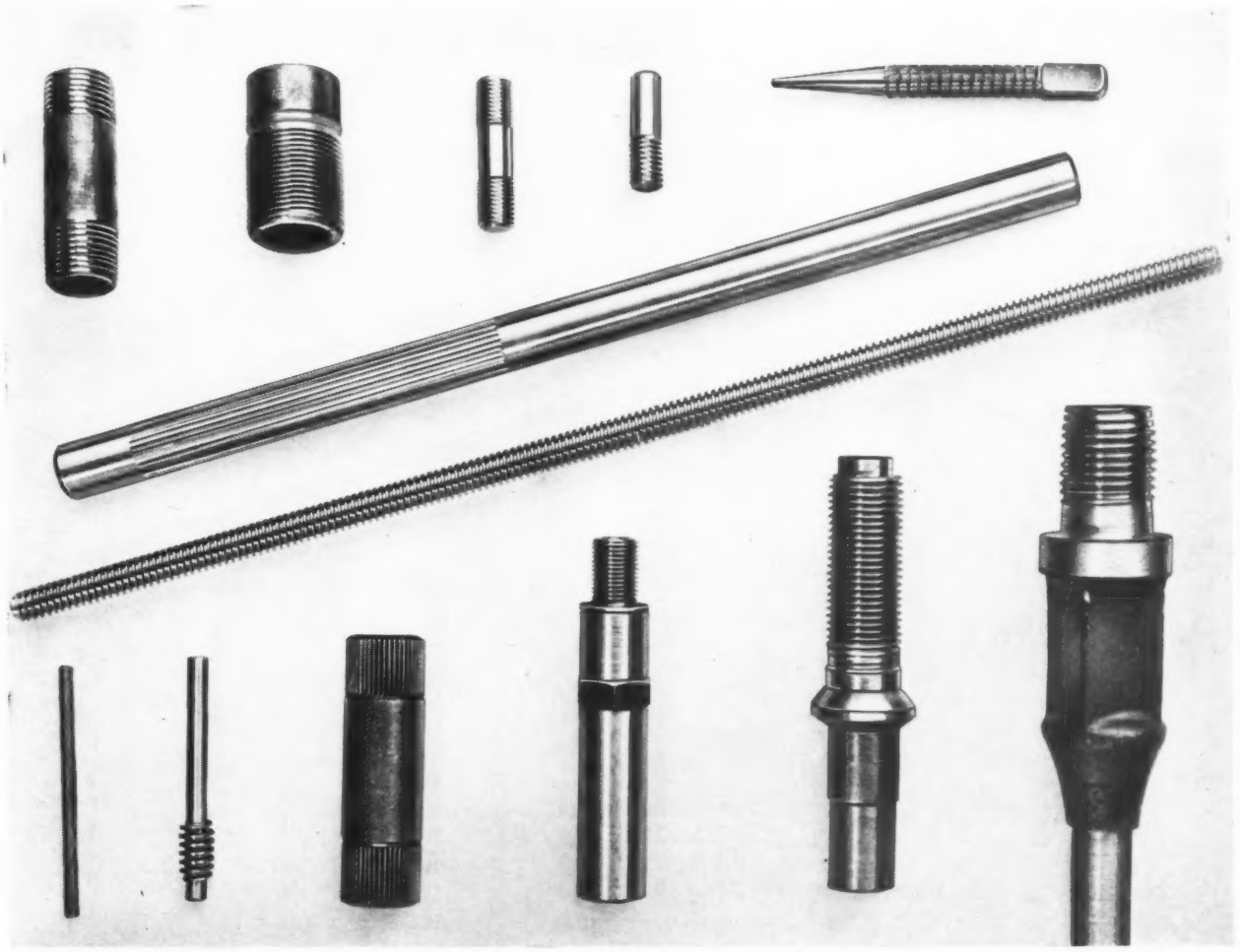
The construction of the operating head of the machine will be clear by reference to Fig. 2. In the case illustrated, a three-roll head *A* is used, it being preferred to the two-roll unit, since it is self-centering and requires less adjustment in setting up the rolls, and also because longer roll life is usually obtained with this type of unit. The threading rolls *B* are held on spindles *G* by double serrated bushings that permit the rolls to be set at any desired position.

# of Precision Threads

Roll-guide slides *E* are mounted on anti-friction rolls *F* which are held against the cam-ring *C* by the action of spring plungers *H*. The cam-ring turns against the anti-friction backing rolls *J*. It can be seen that the threading rolls are radially in line with the outer rolls *F* of the slides, and hence there is no possibility of distortion in the machine members when pressure is applied during the rolling operation.

In setting up a new piece, the micrometer handwheel *K* is turned until rolls *F* are on the low side of the cam. The machine is then set in motion by pressing the start button, and the motion of the cam-ring is started by depressing a foot-pedal. The cam action causes roll-guide slides *E* to move inward to their limit of travel. Holding this position, the work blank *M* is placed between the threading rolls. The roll slides are then adjusted inward by turning the handwheel until the threading rolls just touch the outside diameter of the work blank. The foot-pedal is now released, permitting the cam to return the roll slides to their original position. Next, the handwheel is again adjusted so that each threading roll will penetrate the work a distance equal to half the depth of the thread to be rolled. Each graduation of the micrometer handwheel equals a 0.0005-inch depth adjustment of each threading roll, which is equivalent to 0.001 inch on the diameter of the work.

Fig. 1. Typical Parts Produced on the New Thread-rolling Machine Developed by the National Acme Co. The Machine is Adapted for Rolling Threads or Producing Knurled, Burnished, or Serrated Sections Such as Shown on Solid or Hollow Parts



In operation, a motor-driven hydraulic unit operates circular rack *L*, by means of piston *O*, to oscillate the cam-ring *C*. The stroke of the hydraulic piston is adjusted so that the threading rolls will move clear of the work upon the completion of the rolling operation. The duration of the piston movement, and therefore of the work cycle, is set by a timer located at the side of the machine. It is graduated in 1/10 seconds, and is set to correspond to the time of the work cycle plus an allowance for dwell. The time at the dwell position usually is about 1/10 second for fine-pitch threads, and 3/10 second for long or coarse-pitch threads, or tough material. Timing is done by trial.

A single hydraulic motor drives the roll-spindles through a central gear-reduction unit; change-gears for various spindle speeds from 75 to 600 R.P.M. are available, selective speeds being obtained through a fluid motor control valve. Both the hydraulic motor and the pump that operates the piston and rack are driven by the same electric motor. Two separate oil compartments are located in the lower frame—one for hydraulic oil and one for lubricating oil. In most cases, the hydraulic oil can also be used for lubrication and coolant. An auxiliary coolant tank can be furnished where extra coarse threads or feed-through types of work require a heavy flow of coolant. A straight hydraulic oil is used on light, short threads, while on heavy threads or hard materials, a water soluble oil consisting of from 10 to 6 parts of water to 1 part of oil is employed.

Operation and Application of the Machine

In operation, the work is fed between the threading rolls *B*. The cam rotates until the cam-ring forces the rolls to the correct depth. When the thread has been rolled, the cam rotates in a counter-clockwise direction until the rolls are out of contact with the work. Long bars are fed directly through the machine, and once the thread-rolling process is started, the work feeds itself. Short pieces threaded to a shoulder are unloaded from the front.

Since the rolling process—whether threading or other operations—involves the pressing of material to the required form (not its removal

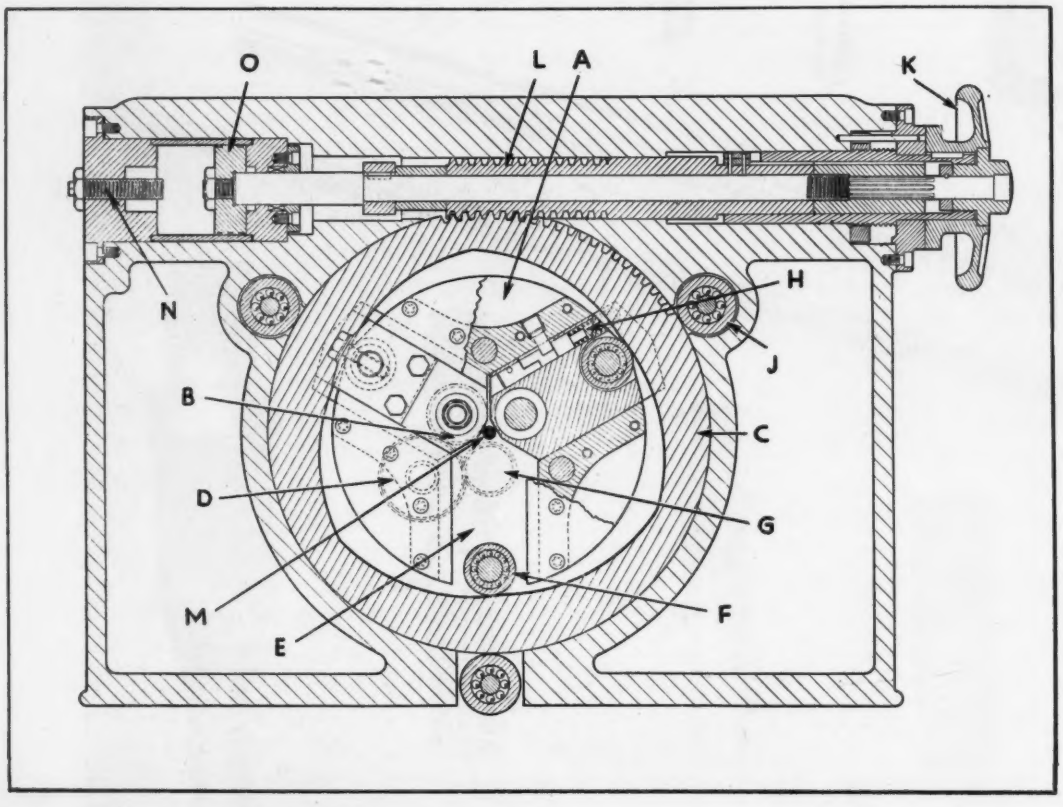


Fig. 2. Work-head A Consists of Slides E on which are Mounted Threading Rolls B. Turning of the Head in the Cam-ring C Moves the Slides to the Operating Position

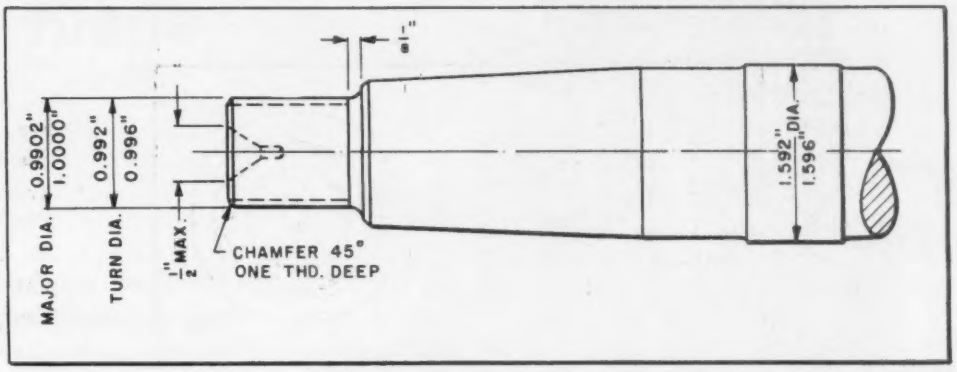


Fig. 3. A 12-pitch Thread, 7/8 Inch Long, is Rolled on This Rear-axle Shaft for Automotive Use in 1 1/2 Seconds. The Production Rate is Thirty to Forty per Hour

by cutting) the degree of precision, smoothness of finish, and improvement in tensile strength of the work will depend on the characteristics of the material, its uniformity of diameter, and the finish of the blank.

When Class 4 threads are rolled, the best results are obtained with carbon or alloy steels which have been surface ground or otherwise accurately finished to size. Steels high in sulphur, aluminum, or brass, all of which are susceptible to flaking, are not desirable materials where precision and smoothness are required.

Heat-treated alloy stock or forgings ranging in hardness up to 30 Rockwell C usually give good results, and alloys of higher hardness can also be rolled successfully; the practical limits are governed by the life of the rolls. Generally speaking, the higher the speed of operation, the better the results and the longer the roll life.

For normal threading requirements, which usually involve the finer pitches, production up to 900 pieces per hour is generally maintained with hand loading. A higher production rate results if the work is adaptable to magazine loading. Coarseness of the thread, type of material being handled, and method of loading and unloading are factors governing the output.

A short part can be rolled to a shoulder within a full thread, but on bar work that is fed through the machine, the form can be rolled within four threads of a shoulder. Eccentric parts can also be rolled, but these require a special holding fixture.

In Fig. 3 is shown part of a rear-axle automobile shaft that is threaded to a shoulder on one end. This shaft is 34 inches long by 1 1/8 inches in diameter, and is forged from S A E 1340 fine-grain steel. A 12-pitch thread, 7/8 inch long, is rolled on the shaft in 1 1/2 seconds. The shaft is supported by a fixture at one end, and rests on rolls against a stop at the entrance to the head of the machine. Whipping is avoided by a safety switch on the fixture, which prevents the head from being energized until a hand locking clamp is closed. The production rate on these parts is thirty to forty per hour.

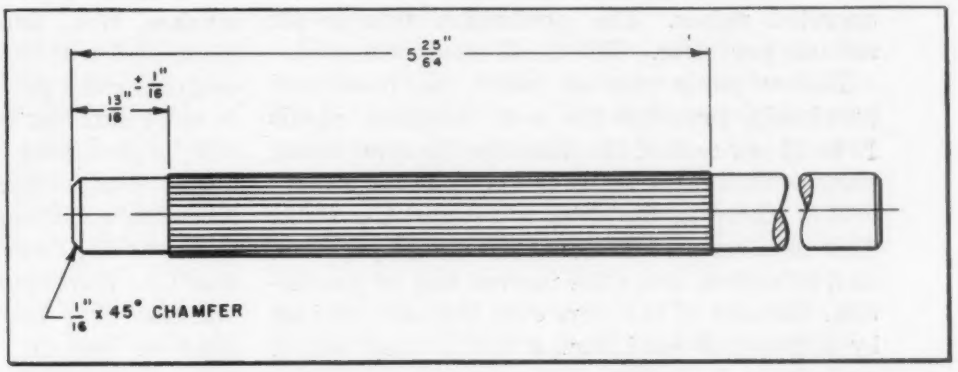


Fig. 4. The Armature Shaft for an Electrical Motor is Serrated as Shown with a Three-roll Head. The Production Rate is Six Seconds per Piece

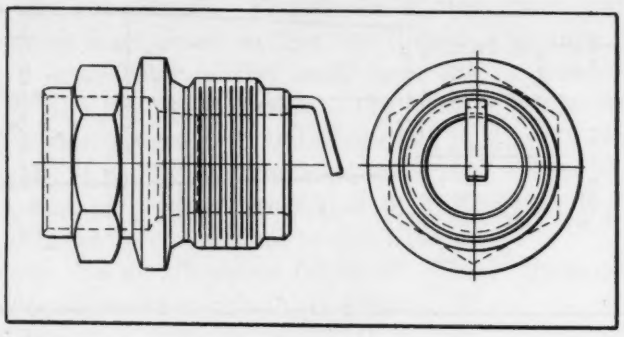


Fig. 5. Shell and Wire Assembly for an Automotive Spark Plug which is Threaded with an 18-pitch N3 Thread. The Steel in This Shell is Similar in Composition to SAE 1113

The finish obtained on a rolled part such as this depends, of course, on the material and on the condition of the rolls. All rolls are ground with a finish equal to a precision-ground tap. The finish on some parts is as low as 6 microinches r.m.s., measured with a Brush analyzer. It is recommended that, before being rolled, all parts be finish-ground, or at least finish-machined, in order to eliminate flaking and insure accuracy.

A different type of shaft—one on which serrations are rolled—is shown in Fig. 4. This is an armature shaft for an electrical motor, and is made of a special steel. The piece is fed into the operating position and stopped until the rolls have penetrated to full depth. Then an automatic feed-cylinder pushes the piece through until the required length of serration is obtained, after which the rolls immediately open and the feed-rod returns to the starting position, ready to feed another piece. These automatic operations are accomplished by the use of National Acme snap-lock switches and solenoid-operated valves. The production rate is six seconds per piece. Three roll-heads are used.

Hollow parts can be rolled, as mentioned previously, provided the wall thickness equals 15 to 20 per cent of the diameter. In some cases, parts with thinner walls can be rolled if a mandrel is placed in the work to support the walls. This involves an additional handling operation, and, of course, slows the normal rate of production. Because of the more even pressure exerted by a three-roll head, such a unit is used almost exclusively for rolling hollow work.

An example of a typical hollow part that is in production at the present time is shown in Fig. 5. This is a shell and wire assembly for an automotive spark plug. The steel is a free-cutting type, similar to SAE 1113 or X1112. The thread is a 7/8-inch long, 18-pitch N3 thread having a pitch diameter of 0.838 to 0.8335 inch, a major diameter of 0.870 to 0.866 inch, and a minor diameter of 0.806 inch maximum. The part is fed by hand to a three-roll head with the electrode intact. The production is at the rate of 1000 pieces per hour.

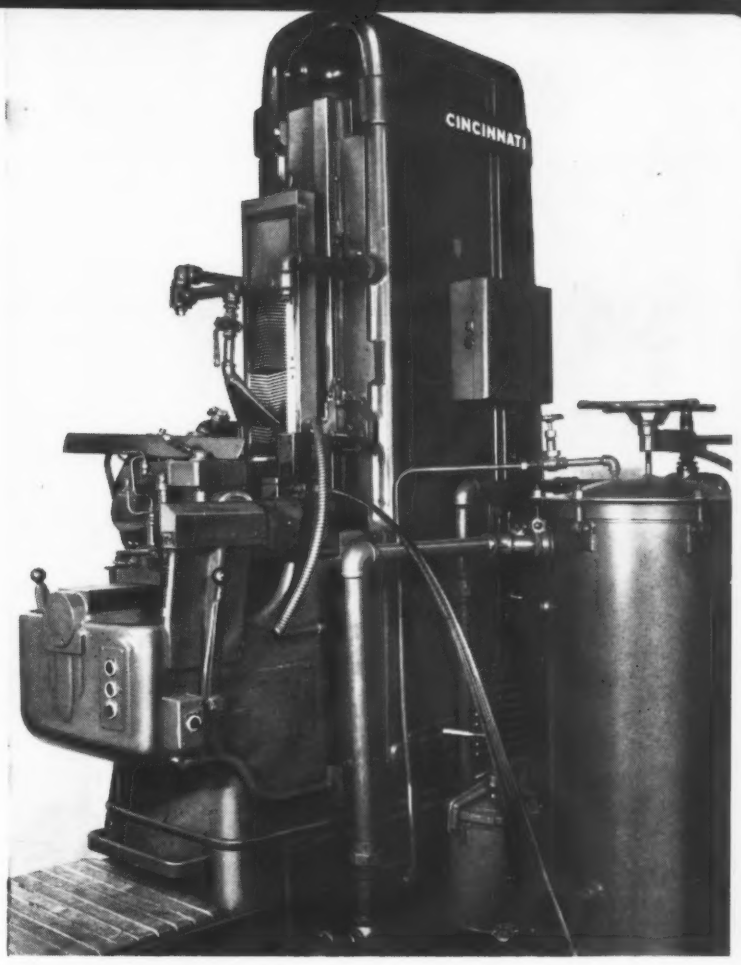
* * *

Tracer-Controlled Machines to be Discussed by Electrical Engineers

The Machine Tool Sub-Committee of the American Institute of Electrical Engineers has scheduled a full-day program of papers and discussions on the subject of tracer and contouring control systems for machine tools as a part of the midwest general meeting to be held in Milwaukee, Wis., October 18 to 22. The session mentioned will take place on October 22. Papers describing the construction and operation of one or more different types of tracer control systems will be presented by representatives of the following companies: Pratt & Whitney, Division Niles-Bement-Pond Co.; Westinghouse Electric Corporation; General Electric Co.; Barber-Colman Co.; Raytheon Mfg. Co.; Cincinnati Milling Machine Co.; Lodge & Shipley Co.; Monarch Machine Tool Co.; and P. M. Sampatacos, Consultant.

Broaching of Teeth Speeds Saw Blade Production

Teeth are Being Broached in over Twelve Miles of Saw Blades per Day on a Single Broaching Machine as Described in This Article. Other Applications of the Ever Broadening Field of Surface Broaching in Producing Teeth and Similar Serrations are Also Described



TEETH are now being formed in band- and hack-saw blades by a new application of the lateral-index method of surface broaching. With this method, high production is attained by passing stacks of as many as twelve blades through the machine at one time, and unlimited lengths of stock can be processed in continuous strips. The straight stroke of the ram and broach enables under-cut gullets to be produced in the teeth.

Since the teeth in a 6-inch length of blade can be broached with a single stroke of the ram, a total of 72 lineal inches of formed saw teeth is produced per stroke when the blades are stacked twelve high. With a 0.124 minute cycle per stroke, 2510 feet—over half a mile—of saw blades are produced per hour.

A 3-ton, single-ram vertical broaching machine built by the Cincinnati Milling Machine Co., Cincinnati, Ohio (see heading illustration), is employed for this operation. A universal fixture, mounted on the table of the hydraulic broaching machine, accommodates stock from 1/4 to 2 1/2 inches wide and from 10 inches to 700 feet long. Saw blades with pitches ranging from 4 to 32 teeth per inch are made with this particular set-up, it being necessary, of course, to change the broach for each pitch blade. Carbon-steel blade strips, 3/8 or 1/2 inch wide by 0.025 inch thick, can be stacked twelve high. Proportionately fewer blades are passed through the fixture simultaneously as the thickness of the stock increases. For example, strips 5/8 and 3/4 inch wide by 0.031 inch thick, and strips 1 inch wide by 0.036 inch thick can be stacked ten high.

The blades are fed through the fixture from right to left. Material of limited length is allowed to overhang the fixture, while longer blades are fed from stock reels and rolled as they emerge from the left-hand side. The stack of blades first passes beneath an electro-limit switch, mounted on the right of the fixture in Fig. 1, the function of which is to automatically stop the machine when the end of any one strip of stock has been reached.

The hydraulically operated shuttle type fixture moves the stack of blades 6 inches to the left between strokes of the ram, unclamping and reclamping the material as the table is automatically withdrawn and advanced, respectively. Details of the clamping mechanism can be seen in the close-up view of the fixture, Fig. 2. Clamping blocks are mounted at the front ends of the hydraulically actuated levers, and rolls are mounted on the front of the fixture to keep the blades aligned below the clamps.

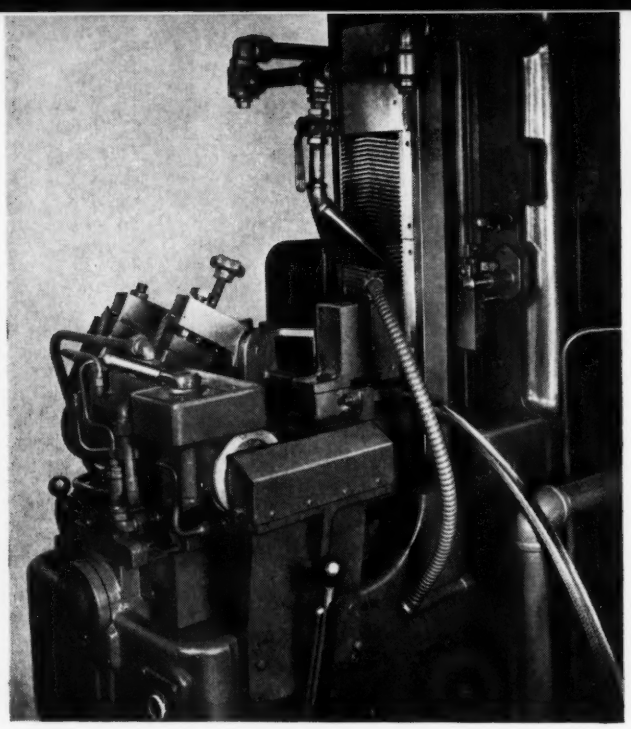


Fig. 1. Set-up for Broaching Teeth in Saw Blades. As Many as Twelve Blades can be Handled at One Time

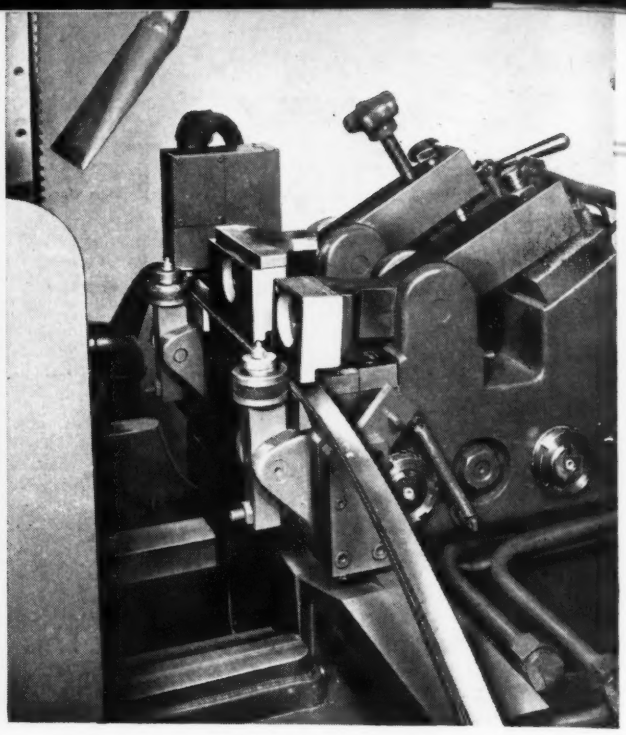


Fig. 2. Close-up View of the Saw-blade Broaching Fixture, Showing the Aligning Rolls and Clamping Blocks

The broach consists of three inserts, of equal lengths. The lower, plain insert shaves the edges of the blades on which the teeth are to be formed. The next insert cuts all of the odd teeth in the 6-inch segment of blades, while the upper insert cuts the even teeth. Broach inserts can be reground from eight to ten times, with a life between grinds of about 360,000 inches of saw length. The broach is fed downward hydraulically at the rate of 41 feet per minute. Coolant is kept free of sludge and chips by passing it through a Hoffman clarifier, which is shown at the right of the broaching machine in the heading illustration.

Another application of the lateral-index method of broaching teeth is shown in Fig. 3. Here rack teeth are cut in carriage stop-bars used in the manufacture of business machines. The same type of machine is used as was employed for the job previously described. In this case, the work is fed from left to right, the fixture and ram being shown at the beginning of the cycle in the illustration.

The stainless-steel bar to be broached is located against an end-stop and clamped hydraulically. After the table has been advanced toward the ram, the broach descends and cuts the rack teeth along one segment of the bar. The table then automatically recedes and a rotary index-bar, shown below the table, moves it to the right the desired amount. This cycle is repeated until the complete length of the bar is broached. For the particular size of bar produced with the set-up shown, the work must be indexed four

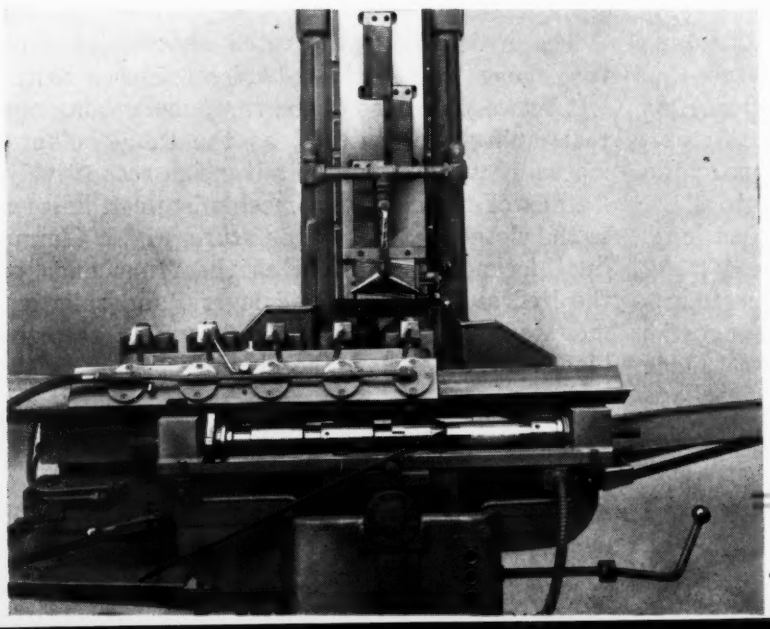


Fig. 3. Lateral-indexing Set-up for Broaching Rack Teeth in Stainless-steel Bars Used in Business Machines

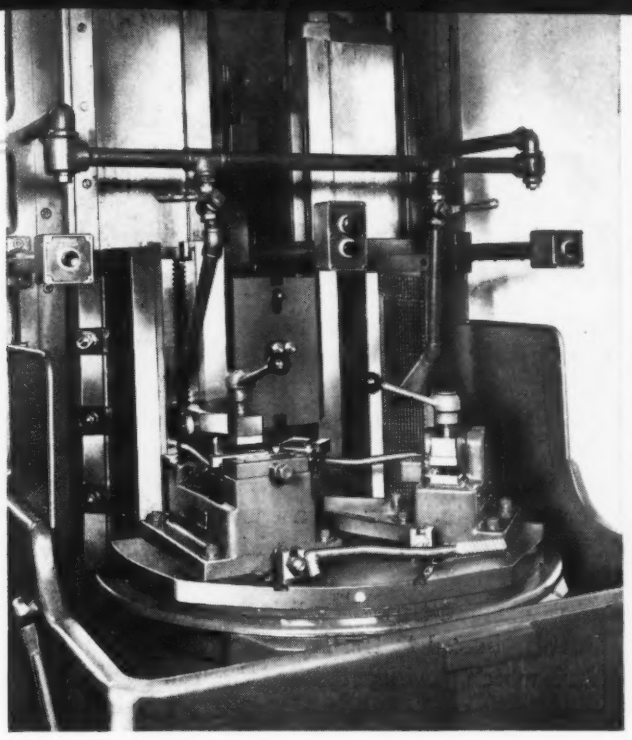


Fig. 4. After Straddle-broaching in Fixture at Left, Teeth are Cut in the Gear-case Racks by Broach at Right

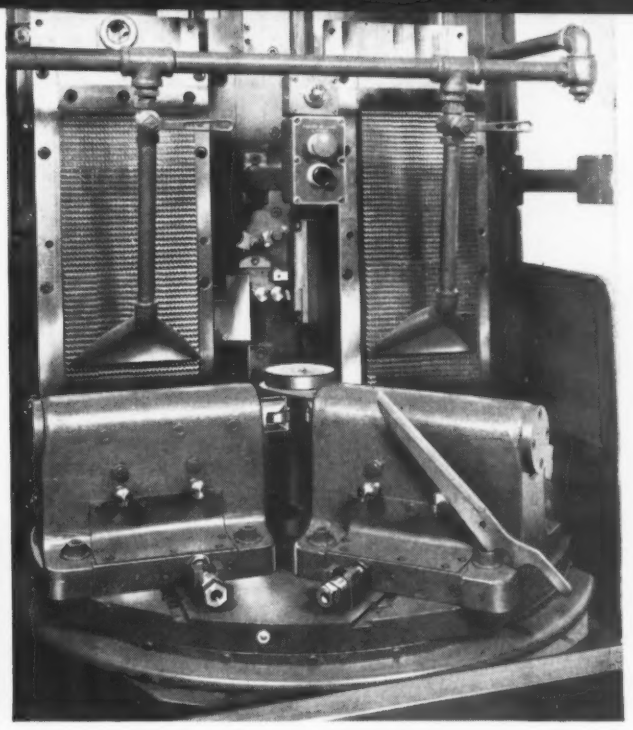


Fig. 5. Notches are Broached on the Outer Faces of Hedge-shear Blades on a Duplex-ram Vertical Broaching Machine

times. By changing the index-bar and broach inserts, rack teeth can be cut in various sizes of bars.

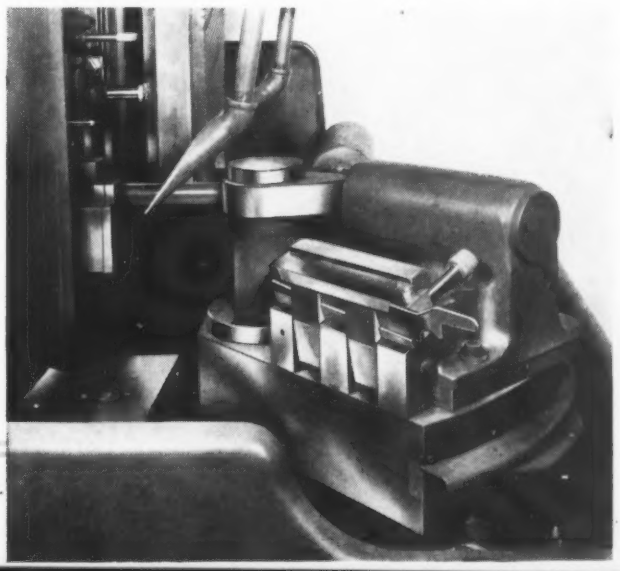
The broach shown consists of four inserts, the lower one of which faces the edge of the bar on which the teeth are to be cut. The remaining three inserts each broach twenty teeth, thus completing a sixty-tooth segment of the bar per stroke of the ram. The broach is fed hydraulically at the rate of 41 feet per minute, and the production on this job is twenty bars per hour.

Teeth are cut in washing-machine gear-case racks by means of the progressive broaching set-up shown in Fig. 4. A duplex-ram, 5-ton vertical broaching machine is employed, and 140 racks are completed per hour. The forged-steel racks are first clamped in the fixture shown at the left. Here the part is straddle-broached, the two sides being machined parallel within 0.0005 inch.

Then the parts are transferred to the fixture shown at the right, where teeth are cut in one of the broached sides. A completed part is shown on the front of the swiveling table. The high-speed steel broach inserts used are fed downward at the rate of 20.6 feet per minute.

Cast-steel hedge-shear blades are notched at the high production rate of 495 per hour with the set-up shown in Fig. 5. A fixture is mounted on each side of the swiveling table. Cam rollers, mounted on plunger valves extending from the inner faces of the fixtures, ride on a disk cam in the center of the table (Fig. 6), thus clamping and unclamping each part when it is moved toward or away from its respective broach. A 5-ton, duplex vertical broaching machine, with a ram speed of 25 feet per minute, is used.

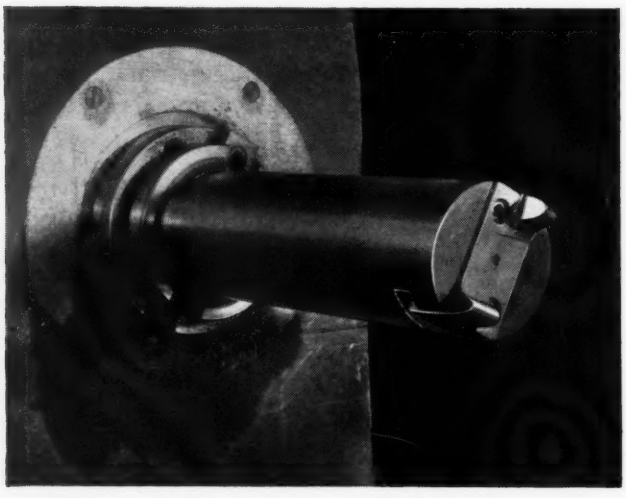
Fig. 6. Close-up View of One of the Two Identical Fixtures Employed in the Set-up Shown in Fig. 5. Clamping is Automatic



Milling Spherical Surfaces without a Form Tool

Fig. 1. Milling a Spherical Bearing Surface on a Split Cast-iron Shell. Finished Parts Can be Seen at Right

Fig. 2. Special Carbide-tipped Milling Cutter and Tool-bar Used to Mill Spherical Surfaces on Bearings



SPHERICAL surfaces can be milled quickly and economically by means of a two-tooth cutter developed by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. This method of machining spherical surfaces eliminates the use of expensive form tools or of a modified lathe with a link motion, and produces high-quality, uniform bearings.

A carbide-tipped milling cutter with two teeth is bolted to the front end of a special tool-bar, which is inserted in the milling machine spindle, as shown in Fig. 2. The diametral spacing between the two teeth is equal to the width of the spherical surface to be machined. The work is held in a vertical fixture, which is clamped to the rotary table of a standard knee type milling machine. With the cutter rotating, the rotary table is fed toward the cutter until the required depth of cut has been obtained.

The job illustrated in Fig. 1 consists of milling a spherical bearing surface about 5 5/8 inches in diameter on a cast-iron shell. The shell is split to permit assembly on the shaft of a flour mill. For this particular part, the milling cutter rotates at 320 R.P.M., and the depth of cut is about 0.015 inch; the work rotates one revolution every 1.75 minutes. Two halves of the shell are milled simultaneously, from four to five cuts being required to complete a shell. The production is three sets of shells per hour.

A similar set-up can be adapted for milling internal spherical surfaces, provided the diameter is large enough, by using a right-angle drive between the cutter and the spindle of a vertical milling machine.

* * *

Historic Shaper Exhibited

One of the most interesting exhibits at the recent machine tool show in London, England, was Maudsley's wooden-pulley and block shaper. Built in 1800, this machine made pulleys and blocks for the Royal Navy in the time of Admiral Nelson, and was in continuous use up to 1944, when it produced pulleys and blocks for the modern navy. This shaper is claimed to be the world's first mechanical machine tool.

The Causes and Cure of Present High Prices

DURING the present month our candidates for national offices will be saying much about the high cost of living. It is safe to forecast that the members of the Democratic party will lay all blame at the feet of the Republicans with spell-binding oratory, and the Republicans will retort in similar vein. Many of us will find it difficult to distinguish between logical arguments and campaign propaganda.

Persons seriously concerned about this problem will find of value a recent bulletin of the General Electric Co. which analyzes the true causes for present-day price tags and outlines a procedure for effecting a cure. Briefly stated, the reasons for high prices are:

1. Government's spending more than it took in.

2. Rationing and price control in war years—without adequate wage control.

3. Necessary shooting away of about half the country's production in the war years, but failure to tax back from consumers—to take out of existence—the extra bonds and money printed during the war to pay for that war production.

4. High cost of government in peacetime—taking almost 20 per cent of the country's production and income for its own purposes.

5. Paying subsidies to put and keep prices up—even in a seller's market.

6. Round after round of post-war general wage increases to almost everybody, thus diluting further the value of money because there was no corresponding individual contribution to increased production.

7. Too-anxious consumer demand for available production.

8. Spending of savings and too much unnecessary buying on credit.

9. Needed aid to Europe, and the new rearmament program.

10. Lowered taxes on individuals—which freed extra money for further upward pressure on prices.

The main remedy suggested for high prices—as reiterated time and again on this page—is more and still more production, coupled with less frequent, heedless expensive bidding up of products. Individuals should stop buying commodities without regard to price, stop using up savings accumulated through the years, and endeavor to build up new savings.

Workers should attempt to produce more, with the full realization that greater production brings benefits to all. Every business should hold back a substantial portion of earnings and plow back this capital into improved manufacturing equipment.

Correction of high prices, obviously, depends upon individual efforts and restraints, as well as upon remedial legislation by government bodies.

Charles O. Herb

EDITOR

Sharpening Carbide Tools

Methods of Grinding Milling Cutters, Form Tools, Reamers, and Boring Tools; Lapping, Stoning, Storing, Handling, and Salvage of Carbide Tools — Concluding Installment of Three Articles

By CHARLES H. WICK

SELECTION of grinding machines and abrasive wheels, relative merits of wet and dry grinding, speeds and feeds employed, and recommended methods of sharpening single-point carbide tools and grinding chip-breakers were described in the two preceding installments of this article, published in July and September MACHINERY. Methods of sharpening carbide milling cutters, form tools, reamers, and boring tools will be described in this, the concluding, installment of the series. Lapping, stoning, storing, handling, and salvage of carbide tools will also be discussed.

How to Sharpen Milling Cutters

Milling cutters should be held on a cutter grinder in the same manner as on the milling machine to insure accurate grinding of the teeth in correct relation to the axis and mounting face of the cutter. Side mills should be ground on a mandrel, and face mills should be bolted to the flange of a face-mill arbor. Shell end-mills should remain on the same arbor employed during milling. Recommendations for milling cutter sharpening vary with the type of cutter. However, certain of the following steps employed for sharpening carbide-tipped face mills are applicable to other milling cutters.

When new tips have been brazed or inserted into place in a face mill, it is necessary to circle-grind the periphery, face, and chamfer of the tool to insure uniform tooth height before grinding the face and clearance lands of each tooth. After circle-grinding the tips, the faces of the individual carbide tips are usually ground first. This practice is also followed in resharpening carbide-tipped face mills. For the grinding operation, the tooth-rest is set up behind the projection of the tooth to be ground. After the cutter has been set up to produce the proper rake angle, the cutter is rotated toward the grinding wheel for each cut. It is generally considered good practice to grind the teeth consecutively after each wheel infeed rather than to grind each individual tooth complete. This permits the teeth to cool between grinds.

Peripheral clearance or relief angles are then ground with either a straight wheel or a cup-wheel. When straight wheels are used, the clearance is obtained by setting the wheel center either above or below the cutter center, depending upon whether the grinding is performed toward or away from the cutting edge. In using cup-wheels, the clearance is obtained by setting the tooth-rest so that the cutter tooth will be turned from the horizontal an amount equal to the clearange angle. If the primary peripheral

Permissible Run-Out for Milling Cutters of Various Diameters

Outside Diameter of Milling Cutter, Inches	Permissible Milling Cutter Run-out, Inch			
	Roughing		Finishing	
	Cutting Face	Outside Diam. and Chamfer	Cutting Face	Outside Diam. and Chamfer
Up to 12	0.0010	0.002	0.00050	0.0015
12 to 16	0.0015	0.003	0.00075	0.0020
Over 16	0.0020	0.004	0.00100	0.0025

land becomes too wide, due to repeated sharpening, a secondary land should be ground from the heel of the tooth.

The relief or clearance angle on the cutting face of each tooth is then ground. If this angle is less than 1 degree, a secondary relief angle is usually provided. Finally, the chamfers of the face mill cutter teeth are ground. The nose angle of a brazed-tip carbide face milling cutter is shown being rough-ground with a silicon-carbide wheel, mounted on a Kearney & Trecker grinder, in Fig. 1.

Milling cutter run-out should be checked with a 0.0001-inch dial indicator to insure conformance with the tolerances shown in the accompanying table. Variation between any two consecutive blades should not exceed one-half of the total allowable run-out for efficient cutting action. Clearance angles and body interference should also be carefully checked.

When an individual tooth of an inserted-blade cutter is badly chipped or worn, the tooth should be removed and ground off-hand to conform with a templet. The blade is then replaced in the cutter body, using a dial indicator to insure uniform tooth height, and the cutter ground in the regular manner. In some shops, all the replaceable carbide blades are removed from the cutter body and ground individually on a small surface grinder while being held in a jig. In most cases, however, the cutter body offers the best support and location for sharpening the tips themselves.

Procedure for Grinding Other Tools

Dovetailed or circular form tools that require regrinding only on their ends or tops should not be ground by hand because of the large flat area of carbide involved. Surface-grinding with the periphery of a wheel is preferred. A down feed of 0.001 to 0.002 inch per pass for roughing and 0.0003 to 0.0005 inch per pass for finishing, a cross-feed of 1/16 inch per pass, and a table traverse of 30 to 35 feet per minute are usually recommended. Flat form tools are sharpened by surface-grinding the top face of the tool with a resinoid- or vitrified-bond diamond wheel.

In sharpening carbide-tipped reamers, it is generally only necessary to grind the 45-degree chamfer with adequate cutting clearance. Occasionally, the radial face of the blades should be ground to remove a rounded or built-up edge. The width of the circular land on the periphery of reamer blades is dependent upon the abrasive nature of the material being reamed, but is generally about 0.010 inch. Chamfers or lead angles of reamers can be sharpened satisfactorily with 220-grit, resinoid-bond diamond wheels of either relatively thin straight style or flaring cup shape.

A Carboloy-tipped reamer is shown in Fig. 2 being ground between centers on a cutter grinder. The operator is adjusting the tooth-

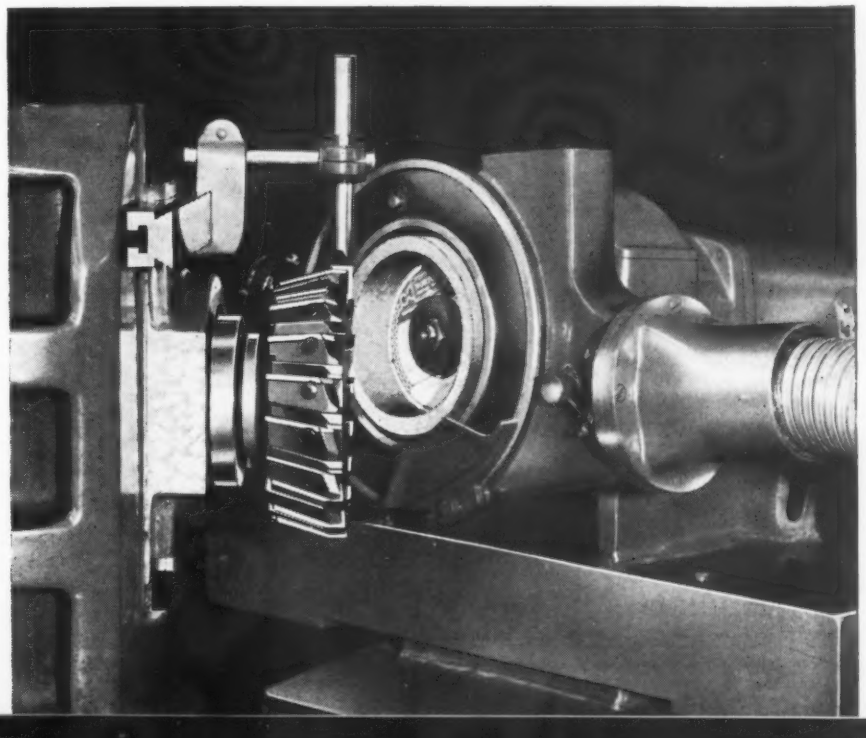


Fig. 1. Rough-grinding Nose Angle of a Brazed-tip Carbide Face Milling Cutter by the Use of a Silicon-carbide Wheel

Fig. 2. Set-up for Sharpening a Carboloy-tipped Reamer on a Cutter Grinder Equipped with a Straight Diamond Wheel

rest to obtain the desired chamfer angle. Since this machine is not equipped for wet grinding, an exhaust hood is located directly behind the wheel to remove loose abrasive.

If the outside diameter of an expansion type reamer is under size, it should be expanded and then lapped to size with diamond powder and oil on a split lap made of bearing bronze. When lapping, the reamer should be rotated in a direction opposite to that employed in operation.

An inside rounded corner is being generated and blended with the clearance angles of a carbide-tipped radius turning tool on the Ex-Cell-O tool grinder shown in Fig. 3. The tool is located above the center of the diamond grinding wheel by placing it on a riser block, keyed to the table, so that the curve formed by the inside diameter of the wheel and the angular setting of the table are combined to give the desired clearance angle. The curve ground on the tool is not formed by a radius dressed on the wheel, but is generated by swiveling the tool around the reasonably sharp inside corner of the wheel. Only a small amount of coolant is used for this operation, so that maximum visibility of the work will be obtained. The ground tool is inspected by means of an optical comparator.

Small, solid carbide precision boring tools are locked in a holder for sharpening on a double-end Ex-Cell-O tool grinder, as shown in the heading illustration. The tool-holder is guided by a protractor mounted on the tool-rest table, which is tilted to the required angle.

Any desired shape can be automatically reproduced on precision boring tools with the Heald tool sharpening machine shown in Fig. 4. In setting up the machine for finish-grinding, the clearance and side angles, radius, and center position of the boring tool are established by means of direct-reading scales. Then it is only

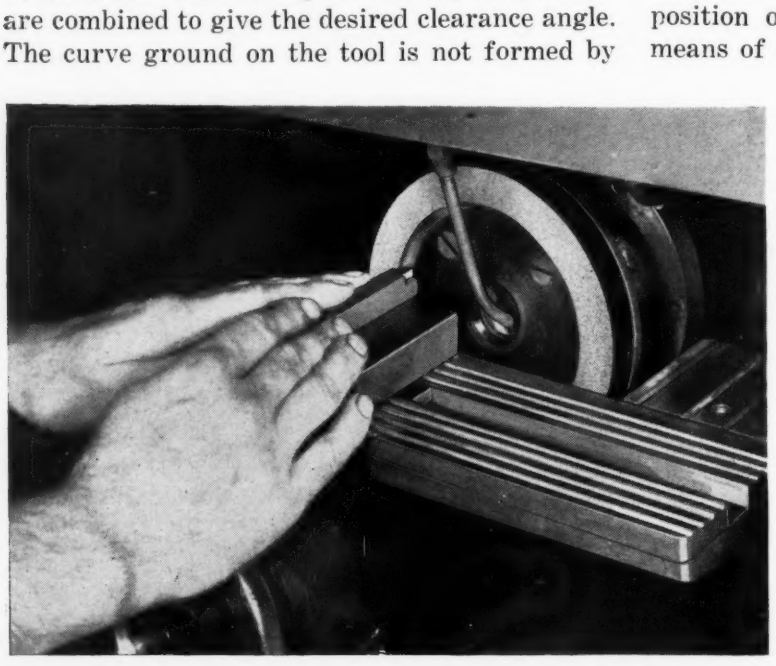


Fig. 3. Generating an Inside Rounded Corner on a Radius Turning Tool by Tilting the Table and Mounting the Tool on a Riser Block

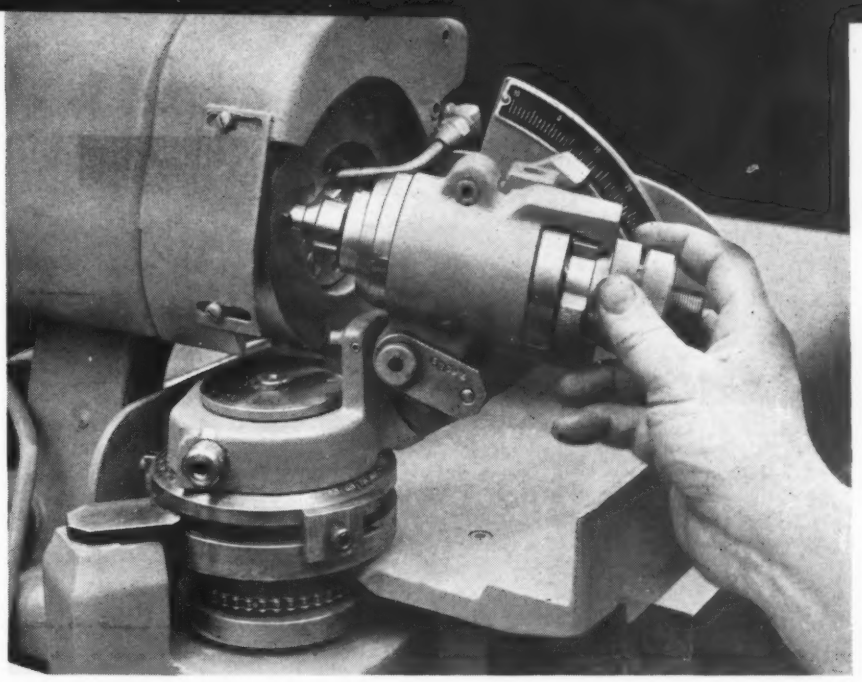


Fig. 4. Various Shapes Can be Automatically Reproduced on Precision Boring Tools after Setting the Scales as Required

necessary for the operator to insert the tool in the holder and actuate the starting switch, after which the machine automatically generates the tool to the desired shape, blending all the clearance angles and rounded corners. Provision is made on the opposite end of the machine for an extra wheel and a free-hand grinding attachment for roughing prior to performing the finish-grinding.

Planer, shaper, lathe, and other single-point tools can be ground to a predetermined contour, with any combination of clearance angles required, on the templet grinder seen in Fig. 5, which is made by the Oliver Instrument Co. The tool-holder is supported at the lower end by a ball-and-socket joint, and has, at the upper end, a templet that is a double-size replica of the tool point to be ground. The grinding operation is continued until the templet contacts a straightedge on the wheel guard, at which point the tool will be ground to the exact profile of the templet, only half size. Templets can be produced from tools directly on the machine.

Finishing Carbide Tools by Lapping

As previously mentioned, the grinding of carbide tools with fine-grit diamond wheels is sometimes referred to as "lapping." However, carbide-tipped precision boring, facing, and turning tools and those used for finishing cast iron and soft non-ferrous metals, such as aluminum, that have a high abrasive action on the tool should be lapped after grinding, as described in the following, to provide a keen cutting edge.

Fig. 5. By the Use of a Templet, Single-point Tools Can be Completely Sharpened in One Set-up on the Machine Illustrated

Although lapping is not considered economical for most carbide tools. tools that have been lapped generally show a longer life between grinds—especially when employed for light cuts. Lapping eliminates grinding marks and removes any feather edge that may have been produced, thus decreasing the friction between the chip and the face of the tool.

Lapping of carbide tools is performed with diamond dust, boron-carbide abrasive, or silicon-carbide finishing compound. Any grade of close-grained cast iron can be used for diamond lapping, and either open- or close-grained cast iron can be employed for compound lapping. Just the right amount of oil must be kept on the lap to prevent rubbing, with the consequent loss of diamond dust or compound. Olive oil, castor oil, or a vegetable compound is generally employed to keep the abrasive in suspension.

Certain tools can be lapped by hand on a grooved block charged with diamond dust. Ma-

Fig. 6. Stoning a 45-degree by 0.005-inch Chamfer on a Carbide Tool that is Used for Taking Roughing Cuts on Steel

chines for lapping carbide tools are usually equipped with a vertical or a horizontal disk directly connected to a motor. A surface speed of from 900 to 1200 feet per minute is generally recommended. Higher speeds will cause the compound to be thrown off the lap by centrifugal force, resulting in uneconomical and slower lapping. The table should be set at an angle 1/2 degree less than that employed for grinding. This develops the cutting edge and saves time, since it is not necessary to lap the entire face of the tool.

Hand-Stoning of Cutting Edges

Hand-stoning (sometimes called "honing") of the cutting edges and nose radius of carbide tools is an effective method of increasing the life of the tool between sharpenings, if done by a careful and experienced operator. Stoning is performed after grinding when lapping is omitted, but more often it is done between sharpenings without removing the tool from the machine. The hone should be kept clean and moist with kerosene.

A few light strokes with a vitrified-bond, 400- and 500-grit, double-end diamond hand hone is all that is generally required to remove small particles of metal clinging to the cutting edge and produce a clean sharp edge. A hand hone, about 1/4 by 7/16 by 4 inches, with 100 concentration and a diamond depth of about 1/32 inch, has been found most suitable. Care must be exercised by a skillful operator to hold the hone flat against the surface of the tool and thus avoid rounding of the cutting edge, altering of the original angles, or, in the case of multiple-tooth miller cutters, impairing the concentricity. Many firms will not permit hand-stoning because of the variation in the results obtained.

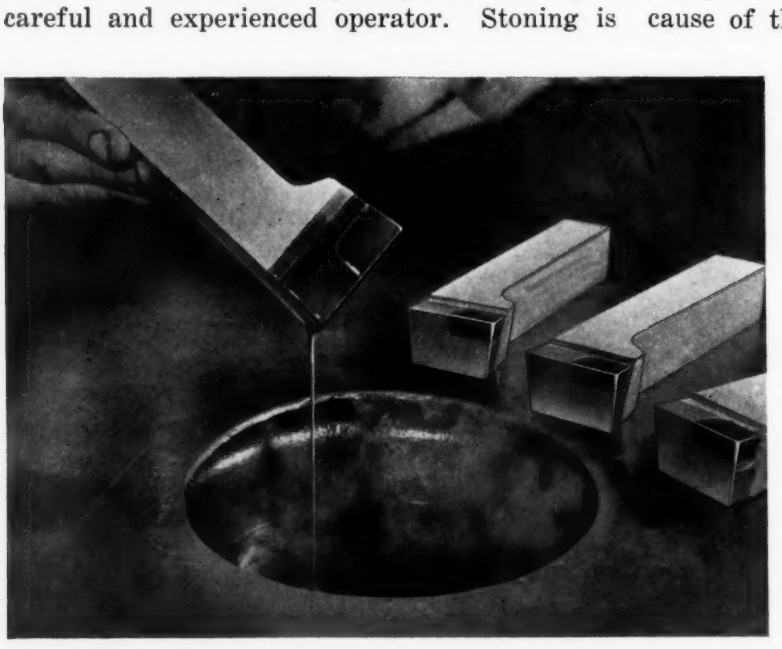


Fig. 7. Applying a Tough, Transparent Coating of Plastic to Carboloy-tipped Tools in Order to Protect the Cutting Edges

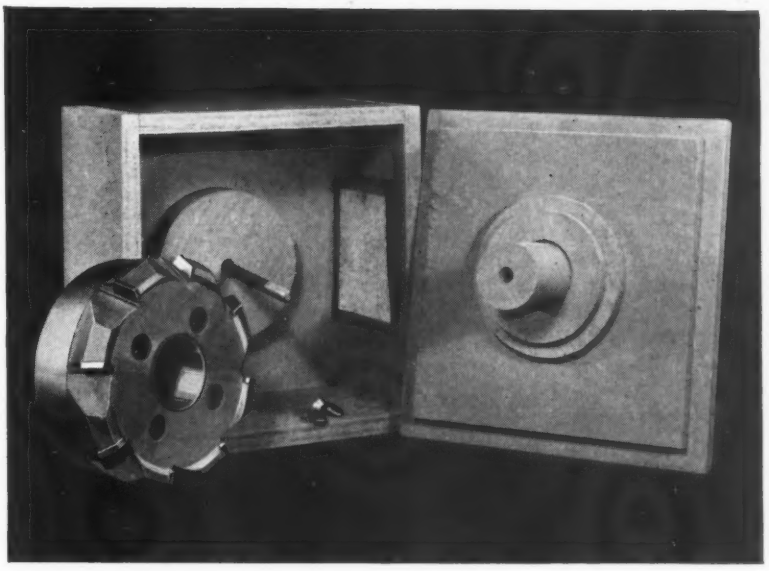


Fig. 8. Wooden Box of the Type Recommended for the Storage of Carbide Tools to Prevent Damage to the Cutting Edges

For roughing tools employed in taking heavy cuts on steel, it is recommended that a hand stone be used after sharpening to provide the cutting edge of the carbide tool with a 45-degree by 0.005-inch chamfer, as shown in Fig. 6. A considerable increase in the length of time between regrinds will result with such tools because scale or heavy chips will not flake off this type cutting edge as easily as off a sharp edge.

Storing and Handling of Carbide Tools

Carbide tools that are to be stored after sharpening should be dipped in ethyl cellulose or a similar material that will form a tough, protective coating of transparent plastic. Such a coating can be quickly removed, when necessary, by slitting with a knife and peeling. The plastic cover can frequently be used again by slipping it over the same tools, or it can be reclaimed by melting. A Carboloy tool is shown in Fig. 7 being removed from a molten plastic bath. Tools with coated tips are shown in the background. Caps of rubber or other soft material can also be used to cover the cutting edges when the tools are not in service.

Strong wooden boxes should be provided for storing and transporting carbide tools. The tools should be so positioned as to clear the sides of the box and protect the carbide cutting edges. The inside dimensions of the box should be sufficient to enable the tool to be removed with the hands instead of having to turn the box upside down and dump the tool out. A wooden box of the type used by the Cincinnati Milling Machine Co. to store face mills is shown in Fig. 8.

Carbide tools should be marked with their serial numbers, the grade of the carbide, the manufacturer's name, the axial rake angle, and the radial rake angle. Also a record card should be secured to each individual tool box indicating, in addition to the above information, the other angles of the tool, the wheel grit to be used in both roughing and finishing, the date when the tool was last sharpened, and the number of pieces produced before the tool became dull or was removed from the machine. Such reports should be reviewed periodically with a view to improving the design of tools that fail or correcting faulty grinding or usage.

Salvaging Broken Single-Point Tools

Single-point tools with badly chipped or broken carbide tips can often be salvaged by cutting off the damaged portion and then regrinding the tip. The steel shank should be cut, up to the carbide tip, with a resinoid- or rubber-bonded, aluminum-oxide cut-off wheel. The cut can be completed through the carbide tip by the use of a diamond wheel of 100 to 150 grit, N grade, having a depth of diamond penetration from 1/8 to 1/4 inch. The diamond wheel should be from 3 to 6 inches in diameter by 1/32 inch thick.

The diamond wheel should be mounted between flanges of as large a diameter as possible to insure rigidity and to produce straight cuts. A constant-pressure type of cut-off machine, which exerts only enough pressure to permit cutting, is preferred for this operation, since the diamond wheel should not be forced through the carbide. In a fixed-feed type of cut-off machine, the feed through the carbide should not exceed 0.0005 inch per pass. The wheel should be rotated at 6000 surface feet per minute, and coolant should be applied simultaneously to both sides of the wheel.

Die Maintenance

The System Used by the Worcester Pressed Steel Co. to Insure Adequate Die Maintenance Also Results in Improved Die Design and Reduced Production Costs

By J. WALTER GULLIKSEN
Superintendent
Worcester Pressed Steel Co.
Worcester, Mass.

A DIE maintenance system should have two principal objectives—to keep punches and dies in adequate repair, ready for use at any time, and to so chart the causes of failure that the design of the tools can be constantly improved. The achievement of these objectives results in lower production costs.

The system recently installed at the Worcester Pressed Steel Co.'s plant, Worcester, Mass., is based on the use of three forms—a cream-colored card that is used for routine checks and sharpening; a similar red card for ordering the repair or sharpening of urgently needed tools; and a "Special" card employed when failures are encountered in service.

This plant is a high-production shop engaged in drawing, forming, and stamping such items as parts for electrical appliances, roller-bearing retainers, bicycle sprockets, automotive oil-pans, etc., from stainless steel, brass, and aluminum 1/64 to 1/2 inch thick. The general types of presses include gap-frame blanking presses up to 150 tons capacity, double-action cam presses of 100 tons capacity, 500-ton toggle-action presses, 1000-ton knuckle-joint presses for coining, 25-ton Henry & Wright dieing machines, and several hydraulic presses, including one of 1500 tons capacity. There are approximately 115 presses in the shop and about 28,000 different sets of punches and dies, each of which may include tools for from one to fifteen operations. With such a large number of dies of varied design, it is essential that a system be installed that will insure that the dies will be kept in working order at all times.

For routine maintenance, the form shown in Fig. 1 is used. At the top of the card is listed the tool number, the operation number, and the production order number. Both the tool number and the operation number are stamped on individual punches and dies, or painted on in a conspicuous position. These tools are then stored in the tool vault until needed. If an order is repeated after the completion of the first lot, the punch and die required are checked by the tool repair department according to instructions issued on the repair order form.

The repair order shown in Fig. 1 calls for the checking of four dies—a blanking die, a piercing die, a double-action drawing die, and a striking or sizing die. This repair order shows that 3000 parts are to be produced from stock 0.062 inch thick. If the tool repair department requires additional information on part specifications, it can obtain such data from the production order cards, which are kept on file in the production department.

The tool repair department, Fig. 2, is entirely separate from the tool-room, where the punches and dies are manufactured. Thus, all repair jobs can receive immediate attention and are usually completed in from two to three days. Another advantage of having the tool repair department separate from the tool-room is that new work is not held up for rush repair jobs.

The two upper sections of the tool repair order card accompany the tools to the repair department. The bottom section is kept on file by the tool-vault foreman. On receipt of the order, the repair department checks all dies and punches

System Reduces Production Costs

for broken parts, burrs, sharpness, and for dimensional accuracy. If the punches are slightly under size, they are chrome-plated to bring them within tolerances. All severely worn or broken parts are replaced. The tools are then routed through the tool vault to the production floor, and the tool-vault foreman removes the bottom section of the repair order card from his file. This section of the card is discarded after it has been checked against the top section of the repair order; the second section of the form is used by the tool repair foreman to complete his records.

The same repair order form is used if dies must be removed from production for routine grinding or repair. As soon as the inspection department finds that the die is producing a burr because of dull edges, or that the part is defective because of failure of another section of the tool, the die is removed and sent to the repair department with the tool repair order form. For urgent service, the red form is used. From experience it has been determined that some dies must be reground after a certain number of operations; a standing order is issued for these dies—usually lamination dies and high-production blanking and piercing dies—requiring that they be reground after a specified number of parts have been produced. This number may vary from 5000 to 50,000, depending on the severity of the operation and on the design of the tools.

This particular system is highly effective; it requires a minimum of paper work and insures that a permanent record is kept of all repairs on a set of tools.

For major breaks or failures, the form shown in Fig. 3 is employed. This form is not only an order to the tool repair department but also a report to the assistant plant superintendent on the cause of die failure. All the information for an analytical study of the cause of die failure is included in the form—from data on the number of parts that have been produced by the die to a description of the condition of the press on which it was used. Information on the presses is important, because even should the press be in good repair, it might be too fast or too slow for the particular tools in question or its stroke might be so long that the punch accelerates to too high a speed to obtain long tool life.

It will be noted that approximately 200,000 pieces have been made with the punch and die in this particular case. The die has been partially rebuilt since it was first designed, and production information so far indicates that the design has been satisfactory. Probably the cause of failure — a cracked punch — was due to a

TOOL REPAIR ORDER

To Tool Repair Dept. Foreman Ellstrom

REPAIR X	RENEW	ALTER	CORRECT

Tool No. 23977-B — For Operation — P.O. No. 47-1258

REMARKS

Check all Tools
1 Blanking Die
1 Piercing Die
1 Double Action Draw Die
1 Striking Die

3000 Pieces — 0.062" Stock

DATE WANTED	RECEIVED	DELIVERED
3/9/48		

TOOLS NOW LOCATED IN

DEPT.

PRODUCTION ORDER NO.	OPERATIONS	TOOL NO.	DELIVERED TO TOOL VAULT	A. M.	P. M.

TOOLS NOW LOCATED IN

DEPT.

PRODUCTION ORDER NO.	OPERATIONS	TOOL NO.	DELIVERED TO REPAIR DEPT.	A. M.	P. M.
47-1258	Blank Pierce Draw Strike	23977-B	3/8/48		2.30

Form 86

Fig. 1. Repair Order Form Used for Routine Checks and Maintenance. Instructions to the Tool Repair Department, Including Number of Parts to be Made and Thickness of Sheet Stock, are Given

Fig. 2. The Two Upper Sections of Form Illustrated in Fig. 1 are Attached to the Tools when They are Sent to the Tool Repair Department

Fig. 3. For the Repair of Tools That Fail in Service, the Repair Order Form Shown Here is Employed. The Failure is Thoroughly Analyzed and Steps are Taken to Insure against a Similar Occurrence

REPAIR ORDER

DATE — ISSUED: 3/30/48 | WANTED: 4/2/48 | REC'D.:

ROUTINE CHECK-UP ☐
REPLACE MISSING TOOL — PARTIAL ☐ COMPLETE ☐
SHARPEN ☐ POLISH ☐ ALTER ☐ STONE ☐
GRIND ☐ ADJUST ☐ SHIM ☐ CHECK SIZE ☐
MAKE NEW PART ■ MAKE ENTIRE TOOL ☐
STRENGTHEN TOOL ☐ CHECK ACCURACY ☐

TYPE OF TOOL

BLK.&D.A.DRAW ☐	BLANK ☐	PIERCE & BLK. ☐
PIERCE ☐	FORM ☐	SWAGE ☐
BEND ☐	TRIM ☐	NOTCH ☐
STRIKE ■	S. A. DRAW ☐	NECK ☐
D. A. DRAW ☐	CURL ☐	OTHER ☐

TYPE OF FAILURE

STRUCK OVER ☐	PRESS REPEATED ☐
CRACKED PART ■	FAULTY SET-UP ☐
OPERATOR FAULT ☐	NORMAL WEAR ☐
SCORING ☐	DULL EDGE ☐
SCRATCHING ☐	TOOL WORN OUT ☐
WEAK TOOL ☐	GRIND DEFECT ☐
	IMPROPERLY HARDENED ☐
FATIGUE ☐	PATCHED UP TOOL ☐
CARELESS HANDLING ☐	STAMP MARK ☐
OTHER ☐	HEAVY BURR ☐

PRESS CONDITIONS

PRESS NO. 59 OPERATOR NO.
HOLE IN BOLSTER TOO BIG ☐ DIE IMPROPERLY SUPPORTED ☐
OTHER ☐

MATERIAL

O. K. ☒ HOW THICK 0.125
BURR ☐ SCALE ☐ CRACKS ON BENDING ☐

DELIVERY REPAIRED TOOL

TOOL NO. 28820
P. O. NO. 48-11232
NATURE OF REPAIR:

KIND OF TOOL STEEL: Bethlehem No. 67 Chisel Tool Steel
DATE DELIVERED TO VAULT CONDITION SATISFACTORY
J. Ellstrom
Signed Tool Repair Foreman

TOOL NUMBER 28820

OPERATION NO. 5 | OPERATION NAME STRIKE RIBS

CUSTOMER TOOL OWNED BY W.P.S. CO. ■ CUSTOMER ☐

P. O. NO. 48-11232 PCS. 1200 STOCK THICKNESS 0.125

1st FAILURE ☐ 2nd FAILURE ■ 3rd FAILURE ☐
DATE FIRST DIE BUILT
HAS DIE BEEN REBUILT? YES ■ NO ☐
PARTIALLY ■ COMPLETELY ☐
TOTAL PIECES DIE HAS MADE 200,000
HAS SAME DETAIL BEEN MADE BEFORE? YES ☒ NO ☐
HARDNESS: ROCK "C" 58
ENOUGH SURFACE REMOVED? YES ☐ NO ☐
KIND OF TOOL STEEL USED Water HD.C Tool Steel
SATISFACTORY DESIGN ■
SATISFACTORY WITH DESIGN CHANGE ☐
SATISFACTORY WITH T. S. CHANGE ■

REMARKS:
Use tougher, medium carbon tool steel - Bethlehem No. 67 Tool Steel

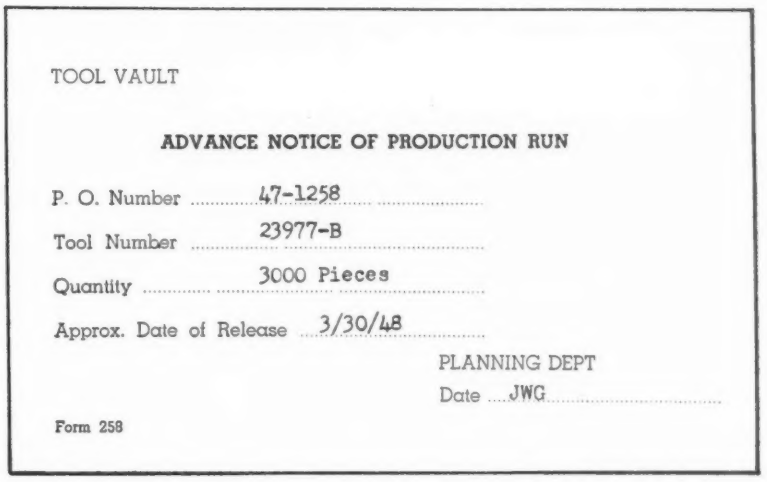
RECOMMENDATIONS

PUT ON DIE SET ☐ RE-DESIGN ☐
CHANGE DIE TO OTHER PRESS ☐ OTHER ☐

WALKER 3/8/48
Signed Date

VAULT CHECK STUB

OPERATION NO. 5 | TOOL NO. 28820 | P. O. NO. 48-11232
NAME Strike | SENT TO REPAIR 3-8-48
New Punch | WANTED 3-10-48



TOOL VAULT

ADVANCE NOTICE OF PRODUCTION RUN

P. O. Number 47-1258

Tool Number 23977-B

Quantity 3000 Pieces

Approx. Date of Release 3/30/48

PLANNING DEPT

Date JWG

Form 258

Fig. 4. An Advance Notice of a Production Run is Given to the Tool-vault Foreman, so that the Tools will be Ready when Production Order is Issued

fatigue failure, although it has been discovered that in many cases failure usually attributed to fatigue is due to careless handling or improper set-ups on the presses. The recommendations to the tool repair department are that a tougher medium-carbon steel be used. Many punches and dies are made of water-hardened tool steel with a carbon content of approximately 1 per cent. However, the use of this steel is generally limited to cylindrical shapes or those easily accessible for reworking.

When this repair order has been completed, it is attached to the broken tool and sent to the tool repair department. If necessary, a sketch of the broken portion of the tool is made on the back of the card. A vault check stub (lower right) is filed by the tool-room foreman, and on delivery of the tool, a receipt is signed by him which is returned to the tool repair department. The main portion of the repair order form is filed in the tool vault after it has been reviewed by the plant superintendent and others concerned.

Although this card system has been in effect only a few months, it has already resulted in reducing the number of major failures. One common cause of failure is due to misalignment of the punch with the die. In the majority of cases, this condition is remedied by specifying a die set for the tools; many punches and dies are used without a die set because the tolerances on the part and the quantity required do not justify the additional cost. Other failures have been due to operator negligence, incorrect selection of tool steel, faulty material, improper lubrication, fatigue and crystallization of the metal, wear due to long usage, and, occasionally, faulty design of the tool.

To further minimize the possibility of tool failure during a production run, advance notice is given to the tool-vault foreman of orders that have been received. The advance notice slip, Fig. 4, lists the production order number, the tool number, and the anticipated release date on the order. In this way, the tool-vault foreman has ample time to look up the required tools and make sure that they are adequate for the coming production run.

* * *

New Motor Designed for Aircraft Application

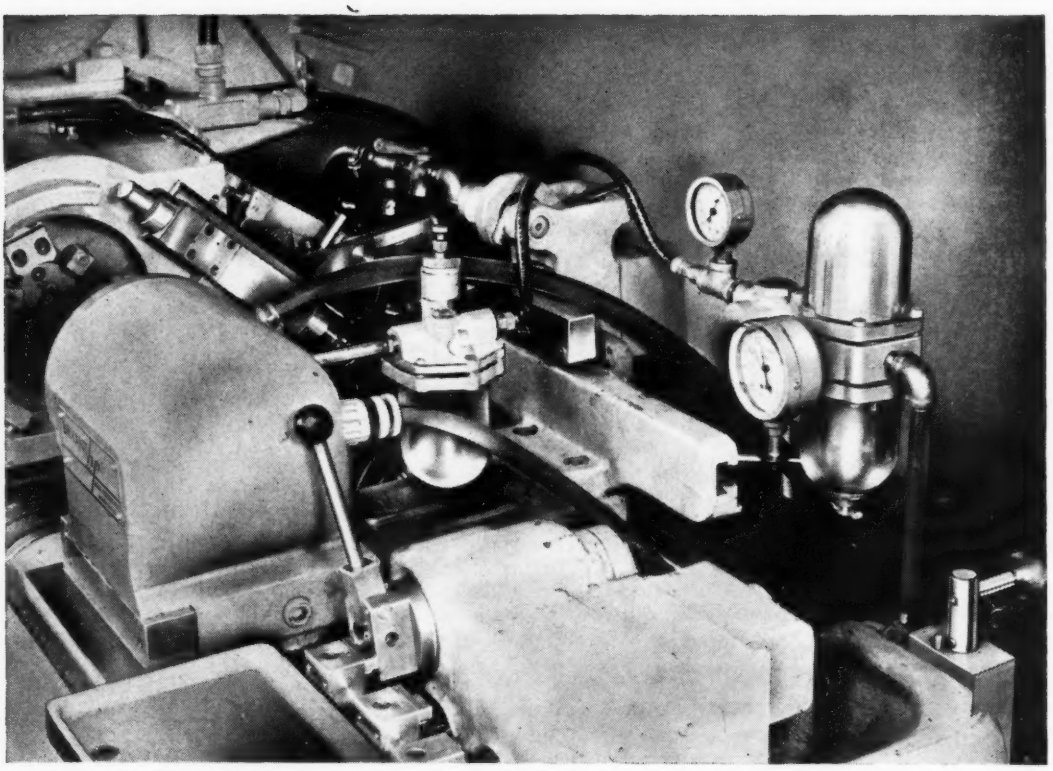
The rapidly expanding electrification of aircraft has resulted in the design of a number of new motors with interesting features. One unit has been developed by the Westinghouse Electric Corporation that has a capacity of 9.24 H.P. at 27 volts direct current and runs at 3600 R.P.M., for driving an air-conditioning compressor on one of the big commercial airliners; it weighs only 53.5 pounds. (A standard open-frame 10-H.P., 3500 R.P.M., direct-current motor weighs 255 pounds.) The new motor is explosion-proof and has a ventilating system of its own by which air is drawn from the outside.

* * *

New Edition of Bluebook of Stamping Manufacturers Available

The Pressed Metal Institute, 829 Union Commerce Bldg., Cleveland, Ohio, announces that the 1948 supplement to Volume 4 of the "Bluebook of Stamping Manufacturers" is now available to buyers of stampings. Listed in the supplement are the names and facilities of members who have joined the institute since October, 1947, as well as present officers and trustees.

Methods of Lubricating



Effective Lubrication is of Prime Importance in the Efficient Operation of High-Speed Ball Bearings. Various Methods of Lubricating and Their Effects are Discussed in This Article

By A. F. BREWER
Technical and Research Division
The Texas Co., New York, N. Y.

BALL bearings, unlike plain bearings, do not fail by reason of wear or abrasion—a change occurs in the surface of either the balls or races (or both) to cause flaking or spalling off of minute particles. Lubrication, which keeps the rotating surfaces continually wet with a film of oil, reduces the spot temperature condition which would otherwise lead to metal fatigue. Obviously, it is most important to prevent metal fatigue in a high-speed bearing where hundreds of millions of revolutions are required between overhaul periods, or in some cases, even between shutdown periods. Oil is the ultimate lubricant, regardless of whether the lubricating film is developed by some means of dispersing fluid oil or whether the required oily component for the film is "bled" from the soap base of a grease which is so applied as to be in intimate contact with the rotating parts of the bearings.

Lubrication at the load-carrying surfaces which involve rolling contact, in the opinion of some authorities, is primarily for corrosion prevention. Any sliding velocity which occurs, due to the finite contact ellipse, probably is accompanied by such high contact pressures that oil film action seems unlikely. The major function of the lubricant in a high-speed ball bearing would seem to be to minimize friction between the balls and the ball separator.

Most effectual lubrication of a high-speed bearing by means of oil is attained when the volume of oil circulated over the bearing parts is controlled so that just a sufficient amount is applied to wet the rolling surfaces. Obviously, an excess of oil, such as would result from flood

High-Speed Ball Bearings

lubrication, might seriously affect the maximum speed of the rotor due to oil churning.

The oil-mist lubricator is a device that injects oil drop by drop into a stream of low-pressure air which breaks up the oil into a fine mist. A regulator is provided ahead of the lubricator to accurately control the air pressure admitted to the lubricator. A high-quality filter should also be inserted in the line ahead of the lubricator to provide clean dry air. The oil-mist lubricator illustrated in Fig. 1 produces particles of oil so finely divided as to become a fog. In operation, a vacuum is created by the air stream which draws oil through the orifice into the air stream, thus forming the so-called fog. The rate of oil consumption can be limited to a few drops per hour. This fog is so finely divided that it can be distributed to many bearing locations. Also, by means of mist producing fittings, this fog can be transformed back to mist or spray or even drops, whatever is required on the bearing location. All this is done from a single lubricator.

This type of lubrication assembly is widely used for high-speed grinding machinery spindle lubrication. Since it requires air under a certain amount of pressure, obviously it is most applicable to stationary machines. The heading illustration shows a Norgren oil-mist lubricator with air filter and regulator applied to the spindle head of a Bryant chucking grinder.

Advocates of oil-mist lubrication claim that:

1. The air portion of the air-oil fog provides a cooling medium which maintains uniform spindle temperature.

2. By permitting the fog to continue flowing for a short time after shutdown, the creation of a partial vacuum within the spindle housing as it cools down is avoided, and harmful grit will not be drawn into the housing.

3. The particles of oil penetrate the hard core of air surrounding the rapidly rotating bearing to lubricate it without causing uneven rotation.

4. Only new oil is ever carried to the surfaces of the bearing.

5. Air pressure slightly above atmospheric is maintained inside of the spindle housing to prevent entrance of foreign matter, such as abrasives and coolants.

Oil-mist lubrication is not measured lubrication in the true sense of the word, although the procedures perfected provide for very accurate control in terms of drops of oil delivered by the oiler or the wick. Aircraft designers, in seeking for a satisfactory method of lubrication for the high-speed ball bearings of cabin refrigeration and pressurization equipment, have adopted wick lubrication. The desired oil mist is obtained by submerging one end of a wick in an oil reservoir, the other end being in contact with the high-speed rotating shaft, as shown in Fig. 2. At this point a spray of oil is thrown off. Air draft draws this spray into the bearings;

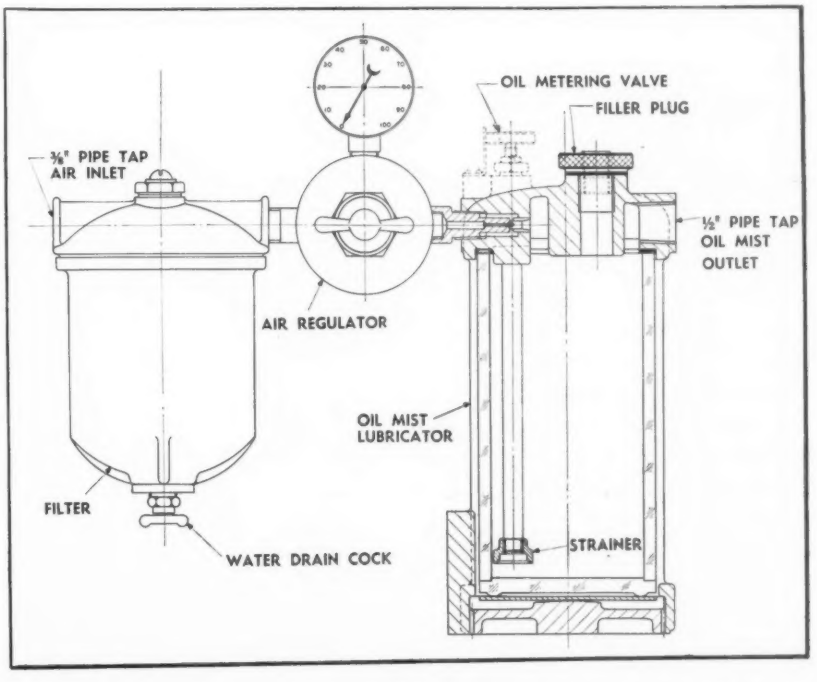


Fig. 1. Diagram of an SKF Oil-mist Lubricator which Supplies a Fog of Lubricant to High-speed Ball Bearings by Injecting Oil into a Stream of Low-pressure Air

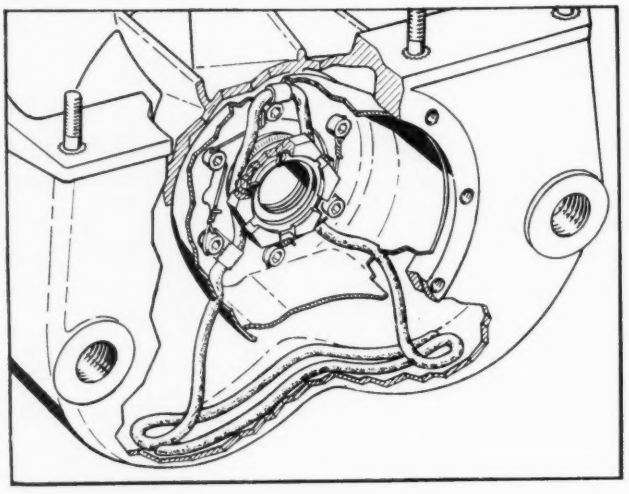


Fig. 2. An Oil-wick Lubricated Installation for an Aircraft Cabin Compressor

no attempt is made to throw the spray directly into the bearings.

The required air draft is developed by a slinger adjacent to the bearings on the end opposite the wick contact point. Suitable grooves convert this slinger into an effective air pump. When this device goes into operation at high speed, a stable oil mist fills the entire bearing space, and because it contacts all parts of the bearing, it develops a very dependable means of lubrication. No attempt is made to use the oil as a coolant, the desired cooling being developed by conduction through direct contact with the circulated air. This is a highly effective way of cooling when the heat rejection rates of the bearings permit of air or conduction cooling. When this is not sufficient, oil cooling jets can be used.

Research has determined that the effective oil pumping capacity of such a wick is surprisingly high. The rate of oil flow through a 1/8-inch felt wick in contact with a high-speed shaft is as much as 20 cubic centimeters per hour, by actual observation.

Some atomization of oil is also attained when high-speed bearings are to be lubricated by attaching oil slingers to the shafts. As the latter rotate, the slingers, which dip into an oil reservoir below, carry a continuous film up into the upper part of the assembly, where it is thrown off. An atomizing effect results as oil passes through the bearings. Design of the bearings includes apertures of varying size and number which promote the atomizing effect. Examples of this method of lubricating bearings are shown in Figs. 3 and 4.

Metered mist is another interesting method devised for maintaining dependable oil lubrication of high-speed spindle bearings, especially for woodworking machinery. Metered-mist lubrication employs the centrifugal force developed by spindle rotation as the power for maintaining the oil feed. Fig. 5 illustrates the principle of operation.

As shown at *A*, the hollow spindle is the oil reservoir. Air is trapped in the upper part by the feed-tube, preventing over-filling. As the spindle turns, centrifugal force drives the oil against the walls of the reservoir (see view *B*). The air that was trapped forms the core extending upward into the feed-tube, thus preventing oil leakage. The only points for oil escape, as seen at *C*, are through metering elements *a*. Being of predetermined porosity, these permit only the desired amount of oil to pass in a given time. They also break up the oil into mist-like particles. As the oil leaves the metering elements centrifugal force carries it through spaces *b* into bearing chambers *c*, as indicated at *D*. Metered-mist oiling is practicable in any plane.

To provide a quickly available source of oil for high-speed motor spindle bearings during the first few seconds of operation, a unique priming cartridge has been developed for use with a metered-mist system. The priming cartridge is shown in Fig. 6, where *A* is the porous metering plug; *B* the open feed channel; *C* the bearing chambers; *D* lubricant on the walls of the reservoir; *E* the wall cutaway; and *F* a porous plug. The direction of lubricant through this plug is toward the axis of rotation. *G* is the priming cartridge. When rotation ceases, the priming wick *H* absorbs the lubricant and holds it for re-

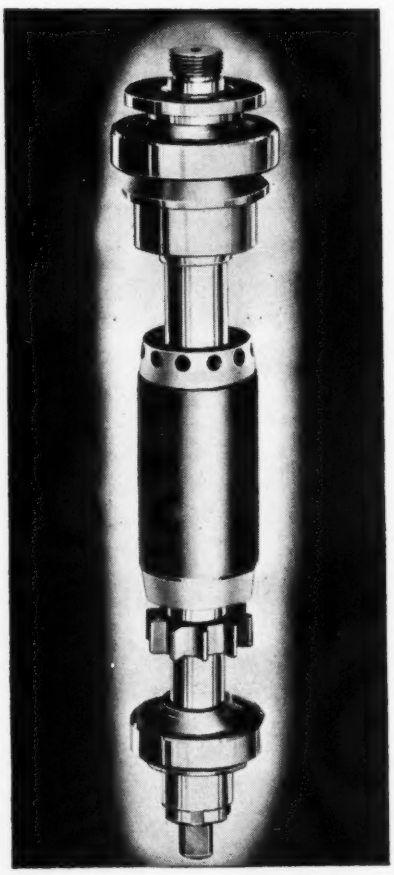


Fig. 3. Whitney Woodworking Shaper Assembly, Showing the Over-size Spindle, Heavy-duty Bearings, Fan, and Oil Slingers

circulation when the spindle begins to rotate again.

This provision for auxiliary lubrication during the start-up period is very desirable where the unit during shut-down may develop enough heat to evaporate the existing oil film from the spindle bearings. High-cycle electric motors running for lengthy periods under severe operating conditions, when stopped for a few minutes, can become so hot as to cause their bearings to run dry until a new oil film is built up, unless means for oil priming are employed. Two or three drops of oil only are necessary to develop complete film coverage of each set of bearing elements and to protect them until centrifugal force and metered mist go into action.

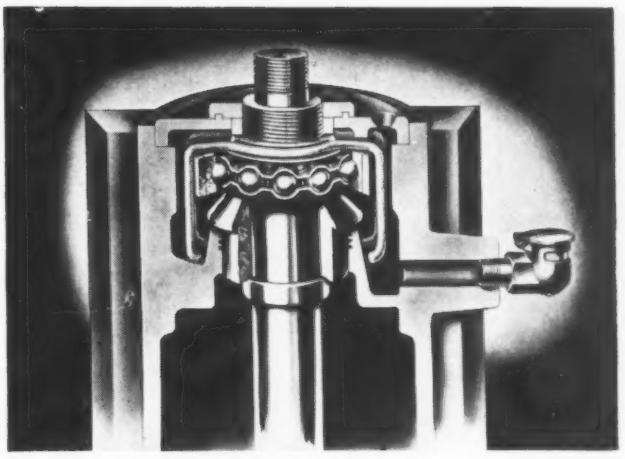


Fig. 4. Whitney Oil Lubrication System, Showing Oil Feed to Ball Bearings by Wicks and Oil Slinger, which Creates a Fine Mist of Oil

Type of Oil to Use

The oil for an oil-mist system should be a comparatively low-viscosity mineral (petroleum) oil (ranging from 100 to around 350 seconds Saybolt Universal at 100 degrees F.). Stability is as important as viscosity, which only indicates the comparative fluidity. The highest degree of refinement is necessary, for the oil must be resistant to oxidation and gum formation. Conditions are favorable to oxidation due to the finely atomized state of the oil as it is directed to the bearing and the fact that each particle is virtually surrounded by air. Furthermore, the warmer the air, the greater the chances of oxidation.

The petroleum chemist has perfected a method of improving the resistance of mineral lubricating oils to oxidation by adding materials that will improve the stability of the oil. Additives also are available which make mineral oils capable of forming rust-resistant films on steels. It is advisable to consider seriously an oil of this type for use in an oil-mist system, particularly if moisture conditions are extreme and machines

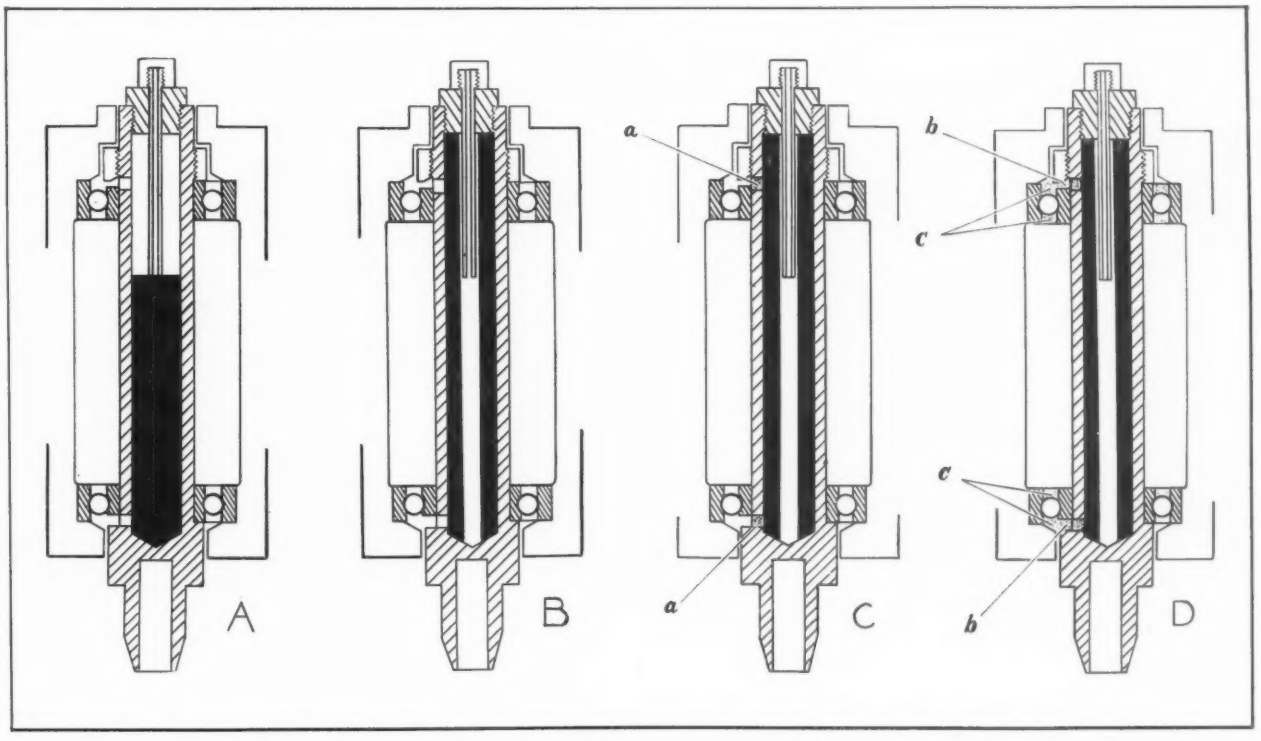


Fig. 5. Diagrammatic Illustration of the Manner in which Metered-mist Lubricating Devices Work. The Hollow Spindle Serves as a Reservoir for the Oil. Metering is Attained by Centrifugal Force which Drives the Oil through a Metering Element of Predetermined Porosity

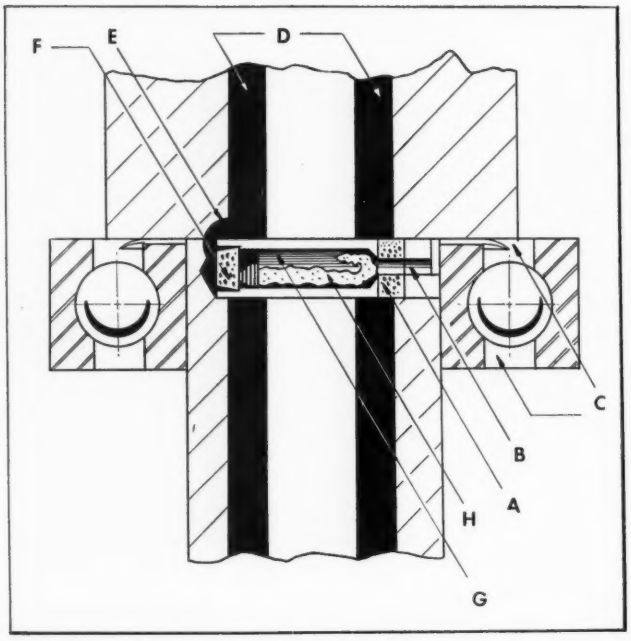


Fig. 6. The Onsrud Priming Cartridge Provides a Quickly Available Source of Oil for High-speed Motor Bearing Spindles during the First Few Seconds of Operation

such as high-speed grinders are involved, which are subject to periodic shut-down. Condensation under such conditions could do serious damage to spindle bearings unless the oil is fortified to prevent rust.

High-speed ball bearings in gas turbines and jet-propulsion engines carry thrust loads of such magnitude that considerable heat is generated in the bearings due to the coefficient of friction. Obviously, this heat must be rejected in order to insure against bearing failure. In the jet-propulsion engines, and, earlier, in turbo-superchargers, this was done successfully by injecting solid jets of oil directly into the bearings, the oil striking either on the side of the ball separator or directly onto the balls. Subsequently the oil is thrown off and scavenged out of the bearing housing as rapidly as possible, thereby carrying off the heat and transmitting it to the oil reservoir where it is, in turn, removed by conduction and radiation. On a bearing having a bore of about 110 millimeters (4.3307 inches), as much as three to ten pounds of oil per minute is injected into the bearing. This enables heavy loads to be carried at high speeds.

In a recent test by one of the builders of aircraft engines, a 7224 size bearing was run under about 12,000 pounds thrust at 8000 R.P.M. Careful observation of temperatures indicated that three pounds of oil per minute was necessary to cool the bearing. Varying the oil flow up to fifteen pounds per minute did not materially decrease the temperature at flows above five pounds per minute. Where jet lubrication of this nature is used, the primary purpose of the solid jet injection is to carry off heat, since very little of this large volume of oil is needed to lubricate the bearing. It has been found to be more effectual than using large volumes of air at low pressure to carry oil mists through the bearing, depending on the volume of air passing through the bearing to cool it.

Lubricating with Grease

Grease packing of ball bearings is successfully practiced where vertical spindles are involved, as on high-speed jig grinders and electric woodworking shapers, some of the former running as high as 60,000 R.P.M. Two high-precision ball bearings carry each spindle. In one very successful design applied to internal grinding service, the bearings are grease lubricated from an annular space located above each bearing. At the time of assembly, grease is packed in by hand; and on some machines, there is no provision for relubrication during the running life of the bearing. Other designs provide for pressure grease-gun relubrication. Lubrication from the original charge of grease is maintained by "bleeding" the grease just sufficiently to maintain a continuous wetting film of lubricant on the bearing parts. Those who favor grease lubrication claim the advantages of low-cost housings, infrequent lubrication, and cleanliness—all important factors in machine design.

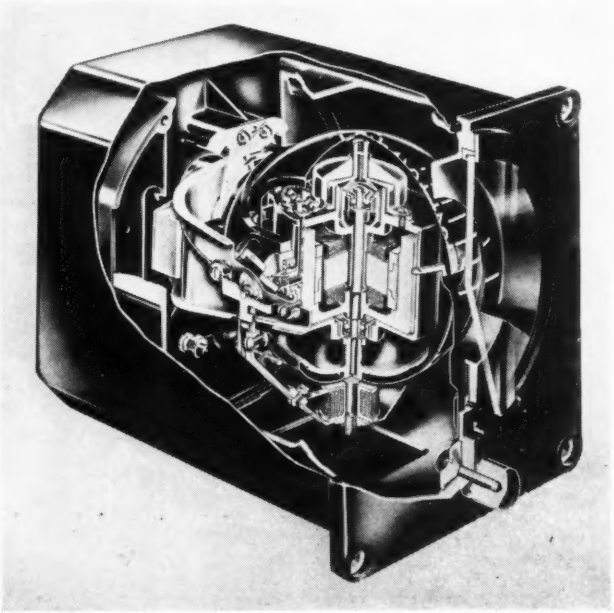


Fig. 7. Section of a Sperry Gyroscope which Operates at Approximately 24,000 R.P.M. The Rotor Bearings are Prelubricated with Grease

Type of Grease to Use

Certain greases susceptible to shear bleed oil readily and are considered suited for the service mentioned. The presumption is based upon the hypothesis that, since such greases may contain a number of occluded oil pockets, the latter (plus shear susceptibility) tend to maintain a semi-fluid oily condition around the moving parts of the bearing. The fact that the grease is packed into an annular space above the bearing indicates the need for a quick-feeding, medium-consistency grease.

Fig. 7 shows a gyroscope which operates at 24,000 R.P.M. and in which grease is successfully used as a lubricant. Fig. 8 illustrates an assembly of the Moore high-speed grinder head, and shows the annular spaces which serve to retain grease for the upper and lower ball bearings; also the grease seal and labyrinth at the working end of the tool which prevent grinding dust and other non-lubricating material from being drawn up into the bearings.

Certain laboratory tests indicate that grease allows a lower temperature rise over ambient than oil. In this regard, the following data is of interest:

Lubricant	Temperature Rise over Ambient, Degrees F.
Spindle Oil with 150 Seconds S.U. Viscosity at 100 Degrees F.....	92
Grease with 105 Seconds S.U. Viscosity at 100 Degrees Mineral Oil	25
Grease with 300 Seconds S.U. Viscosity Mineral Oil at 100 Degrees F.	45

Considerable merit is attached to lubrication of high-speed ball bearings by oil mist, since the amount of actual oil subject to churning is reduced to a minimum. Churning results in heat generation within the volume of oil being agitated and consequently increased temperature of the bearing as a whole. This is not a serious problem in bearings running as high as 5000 to 10,000 R.P.M., provided the unit is exposed sufficiently to the outside air to permit cooling. Where oil is actually circulated through the bearing, the oil itself functions in part as a coolant.

High-speed bearings, however, can be seriously affected by oil churning, the internal friction within causing heat rise and acting as a brake to retard free motion of the bearing elements. This is the primary reason why splash lubrication is not applicable. Oil-mist lubrication prevents these conditions, due to the fact that the relative volume sprayed into contact with the rolling elements is extremely small—in reality, only enough to keep the surfaces wet.

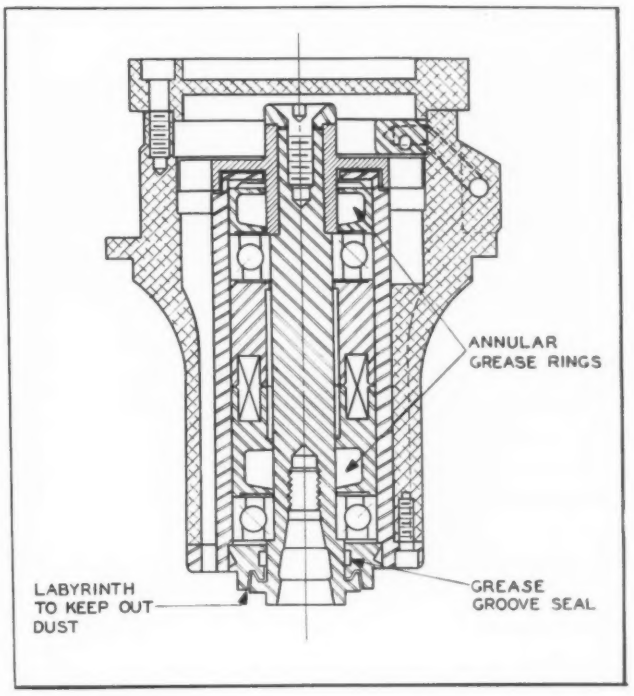


Fig. 8. Cross-sectional Diagram of an Assembly of the Moore High-speed Grinder Head, which Operates at 50,000 R.P.M. Grease is Used for Lubricating the Upper and Lower Ball Bearings

In any high-speed bearing which is provided with oil-mist lubrication, the compressed air used to develop this mist must be as clean, dry, and dust-free as possible. This means that filtered air should be used. The effectiveness of the filtering system will depend upon the source of the air, the location of the compressor intake, the air filters used, the frequency with which they are cleaned, and the possibility of rust and scale forming in air lines due to condensation when the system is shut down. Manufacturers of air-oil mist equipment guard against air contamination by supplying a filter, a moisture remover, and a pressure regulator, so that compressed air from a standard line is properly conditioned before it goes to the spindle.

Minute particles of foreign matter in the air can sufficiently contaminate the oil and penetrate within the bearing to cause noise and rough rolling. If this continues, obviously, the bearing surfaces may become scored—perhaps so severely as to require replacement. Air-oil mist lubrication has a definite advantage in that the pressure under which it is normally maintained will keep fine grinding dust from being drawn into the bearing. Precision bearings are built with clearances as low as 0.0001 inch. Conse-

quently, any foreign particles above this dimension in the lubricant can cause a rough bearing.

Spindles running in ball bearings at very high speeds cause windage, which is one of the reasons for noisy bearings, according to bearing research authorities. Whether or not this noise is objectionable depends upon the service involved. Obviously, it is desirable to have a quiet bearing by noise testing standards, in the beginning. This is one measure of the suitability of the bearing. In service, it may be different. A grinding spindle or cabin supercharger bearing can produce normal noise without objection. A high-speed bearing in submarine service, however, must run as silently as possible to preclude detection of the craft by enemy sonic instruments.

Dirt is one of the primary causes of bearing noise. Even the cleanest bearing—by manufacturers' standards—will give up some dirt when soaked in a solvent. An ordinarily clean grease contains some foreign particles when studied under the microscope. These can be reduced to a satisfactory minimum by proper handling in the manufacturing process—a usual procedure among those companies that make a practice of supplying high-quality lubricants.

Recently, a sub-committee was appointed by the National Lubricating Grease Institute and the Annular Bearing Engineers committee to study methods for determining the number, size, and nature of foreign particles in greases and to prepare recommendations concerning interpretations of the data in terms of their practical significance.

The low-viscosity mineral petroleum oils so widely used in oil-mist systems can be produced virtually dust-free at the refinery. This, however, does not insure that they will remain so when distributed by the oil-mist equipment unless dust-free air is used.

Methods of Protecting Bearings against Dirt

Proper sealing is most important in high-speed bearing operation. Labyrinth seals and slingers have been used to good advantage. When bearings are adequately protected against dirt contamination before, during, and after installation, their life is prolonged and continued, satisfactory operation is more nearly assured. This is particularly true when grease-lubricated bearings are involved. Some spindles may have a tendency to "inhale" after shut-down, others may run with reduced air pressure internally. In dusty atmospheres, this may materially affect bearing operation unless the seals are sufficiently tight and the labyrinths intricate enough to prevent dust being drawn in from the surrounding air.

The problem is not as serious when properly controlled air oil-mist systems are used, where a flow of air through the bearing is continually outward under sufficient pressure to keep fine particles of dust from being drawn in.

The attention given by the anti-friction bearing industry and builders of high-speed machinery to ways and means of insuring positive lubrication is indicative of the importance they attach to this trend toward higher speed operations. It is a fortunate coincidence that either grease or oil can be used satisfactorily, provided the bearings are planned for the specific type of lubrication. Naturally, there are differences of opinion regarding the relative merits of grease and oil, and the essential characteristics.

This article represents a study of the preferred methods of lubrication. Stimulation of interest from a research point of view should result in the development of valuable data concerning the most desirable characteristics of lubricants for high-speed ball bearings.

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Lincoln Undergraduate Award and Scholarship Program

The James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio, announces its annual Engineering Undergraduate Award and Scholarship Program covering the period September 15, 1948, to April 1, 1949. This program offers engineering undergraduates an opportunity to compete in the preparation of papers on various phases of welding for monetary awards, as well as scholastic and industry recognition. Seventy-seven awards will be made to the successful contestants, amounting to a total of $5000. In addition, seven scholarships, equivalent to $1750, will be presented to the institutions whose students receive the three top awards. Further details can be obtained from the Foundation at the address given above.

* * *

A new machine has been developed by the Westinghouse Electric Corporation that is capable of taking X-ray motion pictures at speeds of 150 frames per second and at exposures as fast as ten-millionths of a second. These high-speed X-ray films are expected to be particularly valuable in the study of machinery motions, ballistics, and human physiology.

Condensed Review of Some Recently Developed Materials

Arranged Alphabetically by Trade Names

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Liquid Polishing Compound	**Acme Grade 4-L-10**	A liquid compound which is easily cleaned from the work, leaves the face of the buff soft and clear, and does not clog fluid lines.	For polishing nickel, brass, copper, aluminum, and zinc die-castings. Recommended for use with pressure type composition spray equipment.
Liquid Tripoli	**Acme Nos. 2-L-70 2-L-75 2-L-77 2-L-79**	These liquid tripoli compounds provide considerable savings in buffs, higher color per degree of cut, and ease of application.	Can be used with any type of spray equipment.
Drawing Compound	**Acrawax C**	A synthetic wax which alone, or in conjunction with other common ingredients, markedly reduces friction and heat and decreases scratching and wire breakage in the "dry-drawing" of high-carbon steels. Higher drawing speeds, longer die life, and improved surface of the steel are also obtained.	Has been used successfully in "dry-drawing" high-carbon steel wire rope, spring wire, and tire bead wire. Also has been adopted as a lubricant for drawing bars and rods, as well as odd and round shapes of high-carbon and alloy steels. When added to plastic-molding compounds, it gives anti-static properties to finished surfaces.
Acid Plating Agent	**Actane**	An additive for use in acid dips prior to plating. When used in hydrochloric or sulphuric acid, it disperses and removes colloidal films deposited on metal surfaces during cleaning, thus preventing spotting, streaking, or staining of the plated surfaces.	Particularly satisfactory for use when dipping non-ferrous metals, such as copper and brass, prior to bright nickel-plating.
Cast-iron Flux	**All-State No. 1A**	A cast-iron flux in paste form for gas welding. Is painted on clean surface of iron while casting is still cold. May also be painted on welding rod to provide additional flux as work progresses.	Used in the repair of broken castings, salvage of defective castings, repair of pitted cast-iron molds, and correction of machine shop errors.
Silver Solder	**All-State No. 20**	A 20 per cent silver content solder with melting temperature of 1430 degrees F. and shearing strength of 145,000 pounds per square inch.	Particularly suitable for brazing carbide tips to steel shanks and for fabricating light steel parts. Can also be used on brass, copper, stainless steel, and Inconel.
Brazing Flux	**All-State No. 31-A**	An aluminum flux that melts at about 950 degrees F. and becomes quite active at 1000 degrees F. Gives excellent capillary action to aluminum brazing alloy.	For brazing sheet aluminum.
Aluminum Soldering Flux	**All-State No. 39**	A flux for use with aluminum solder which aids the flow of solder throughout the joint.	Is particularly useful for joining aluminum with ferrous and non-ferrous metals at low working temperatures.
Silver Solder	**All-State No. 111**	A silver solder having a shear strength of 105,000 pounds per square inch and a melting temperature of only 1076 degrees F. Has a silver content of 40 per cent, with the remainder cadmium, copper, and zinc.	Recommended for soldering high-speed steel tool tips with critical temperature ranges to shanks.

Review of Some Recently Developed Materials — Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Magnet Alloy	**Alnico 5**	A sintered permanent-magnet material permitting the economical production of small-sized, fine-grained parts. Has unusually high tensile properties, and can be produced with smooth surfaces and close dimensional tolerances.	Especially adaptable where small powerful magnets having high magnetic properties are required.
Permanent-magnet Material	**Alnico 12**	An alloy of aluminum, nickel, cobalt, iron, and titanium. These magnets are cast and must be ground to shape.	Magnets of this material can be used as tachometer generators and electronic devices.
Aluminum-Bronze Alloy	**Ampco Grade 24**	An aluminum-bronze alloy with high hardness, unusual compressive strength, and marked wear resistance, for use in forming and drawing dies.	Particularly useful in forming and drawing stainless steel, but also adapted for producing parts from carbon steel.
Aluminum-Bronze Alloy	**Ampcoloy 49**	An aluminum-bronze alloy with high tensile strength, which is further increased by cold-working; higher resistance to wear than ordinary bronze; high fatigue and impact values; and good corrosion resistance.	Developed especially for cold-headed parts, such as bolts, rivets, screws, and all types of fastenings. Also makes an excellent spring material.
Aluminum Coating Process	**Anonizing**	A process developed to provide a protective transparent coating on aluminum resembling an anodized coating. The clear, glaze-like coating is not brittle and has good resistance to abrasion, smudging, oxidizing, and ordinary handling.	Practically all alloys of aluminum can be treated, and in most of them the surface color is maintained or improved. Provides an excellent base for paints and lacquers. Application is by immersion in a hot solution, followed by rinsing.
Welding and Soldering Compound	**Anti-Capillary Compound**	This compound limits the flow of molten metal or solder, and helps retain it in the working area.	Can be used with any form of oxy-acetylene gas torch, soldering torch or iron, furnace, or high frequency equipment.
Cutting Compound Base	**Antisep All-purpose**	A base for cutting compounds with high sulphur and saponifiable content, which can be diluted with either oil or water. Has rapid cooling qualities and satisfactory lubricating properties, even when mixed with water. Also possesses rust-preventive properties, preventing corrosion, staining, or pitting of parts.	Is applicable to more than 90 per cent of metal-cutting and forming operations, including general machining, stamping, and drawing.
Non-pigmented Lubricant	**Beacon No. 103**	A drawing compound that can be readily removed from any work-piece to be enameled or bonderized, regardless of time elapsed between die work and finishing. It contains no mineral oils.	For application by brushing or dipping to parts to be drawn.
Spring Material	**Berylco 165**	A beryllium alloy with reduced beryllium content, meeting all performance requirements of ASTM Specification B 194-46T. Lower beryllium content results in increased tool life and lower cost. Available in heat-treatable form and also in mill-hardened form.	The heat-treatable alloy can be used for any stamped, drawn, formed, or blanked part. It is adaptable for fixture hardening or bulk hardening, and for short-time, high-temperature hardening cycles. The mill-hardened alloy is suited for small, high-production parts, such as eyelets, tube socket contacts, rivets, and cold-headed parts.
Steel Coloring Process	**Blu-Blak**	An oxide coloring process developed originally as a gun-bluing method. Provides a uniform coloring to a maximum depth of 0.0001 to 0.0004 inch, and colors from the inside out.	Applicable to all steels including case-hardened and cyanide-hardened parts. Coloring is by immersion in process bath for fifteen to sixty minutes.

Review of Some Recently Developed Materials — Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Corrosion Inhibitor	**Brass Lyfe**	Brass and copper alloy corrosion inhibitor, furnished as a 10 per cent solution of the active organic chemical in butyl cellosolve. Is mixable with oils, lubricants, and lacquers. Completely stops corrosion of copper-containing alloys, whether due to oxygen, organic acids, or amines.	Specifically intended for copper and copper alloys; not effective on any other metals. Can be used in drawing compounds and soluble oils.
Thread Compound	**C-5 Hi-Temp**	Thread compound that prevents freezing and galling of metal surfaces at temperatures as high as 1800 degrees F.	Specifically intended for high-temperature and high-pressure applications, such as furnace tube header studs and plugs.
Cadmium-plating Process	**Cadux HS**	A new and improved bright cadmium-plating process providing a marked increase in brightness of the deposit; higher permissible current densities; and improved covering power and appearance on rough and imperfect surfaces. Under best conditions, mirror-bright deposits are obtained.	For use wherever cadmium-plating is called for. In some cases, a lower grade steel may be employed and satisfactory finish obtained.
Tubing	**Callite Tungsten**	A seamless molybdenum tubing in sizes ranging from 0.040 to 0.500 inch outside diameter and in lengths up to 9 inches. Can be readily machined, shaped, and welded.	Particularly suitable where resistance to hydrofluoric acid, potassium, or sodium hydroxide is needed.
Ground Flat Stock	**Capewell**	A precision-ground flat steel stock manufactured from electric furnace steel and annealed for easy machining. Hardnesses up to 66 Rockwell C can be obtained by proper heat-treating.	Wherever flat steel stock is called for.
Acid-resistant Steel	**Carpenter Stainless No. 20**	A sulphuric-acid resistant stainless steel in the form of bar stock, wire, strip, tubing, and pipe. In addition to superior corrosion resistance, it retains the good mechanical properties of 18-8 stainless steels.	Typical uses include pump shafts and rods, valve stems, tie-rods, pipe lines, fittings, and screens. Used extensively in manufacture of heavy chemicals, organic chemicals, synthetic rubber, high-octane gasoline, solvents, explosives, and plastics.
Light-weight Foamed Plastic	**Cellular Cellulose Acetate**	Combines insulation against heat and cold with unusual structural strength when bonded between two sheets of metal, wood, or plastic.	Can be bonded to such metals as aluminum, magnesium, steel, and stainless steel, as well as wood and plastics.
Chemical Finish for Aluminum	**Chemoxiding**	A chemical process for finishing aluminum and aluminum alloys. Lustrous and glossy finishes that are relatively hard and have high corrosion resistance are produced. Colorings range from light gray through marbleized to light brown, depending upon timing and alloy being treated.	Suitable as a finish in such applications as sheets, tubes, extruded parts, and rods after fabrication; in cases where inserts of steel, brass, or copper are present; where a good base for paints and lacquers is desired; when brazed aluminum assemblies must be processed; when polishing is not required or is too costly.
Cellulose Gum	**CMC**	A compound that greatly increases the viscosity of water and can be used to control the viscosity of any solution in which it is used. It is relatively non-hygroscopic, and is compatible with many water-soluble materals, such as gums, plasticizers, and resins. Also forms tough films and acts as emulsifying agent in oil and water emulsions, protecting the emulsion.	For controlling viscosity of solutions, protective purposes, and other special applications indicated by its properties.

Review of Some Recently Developed Materials — Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Die Steels	**Cobalt-Chrome G.S.N. Olympic Select B**	Dispersed segregate die steels possessing high impact strength. Cobalt-Chrome is a special high-carbon, high-chrome, cobalt air-hardening type. G.S.N. is a high-carbon, high-chrome oil-hardening type. Olympic is a high-carbon, high-chrome air-hardening type. Select B is a modified-chrome air-hardening type. An even dispersion of free carbides in these steels eliminates the grouping together of carbides in a brittle center mass.	For application as die steels wherever more uniform steel, with less warpage and breaking and more consistent results under heat-treating, is called for.
Wire Metallizing Rod	**Colmonoy**	A plastic bonded rod composed of powdered Colmonoy No. 6 for use in wire metallizing equipment.	Upon application, the flame of the metallizing gun burns out the plastic, leaving Colmonoy particles deposited on the sprayed surface. These particles are then bonded to the base metal by the use of an oxy-acetylene torch, induction equipment, or a controlled-atmosphere furnace.
Rust Remover	**CorOdex**	A liquid rust remover that penetrates readily to reach pin-point spots, pits, crevices, cracks, or corners.	Application is by swabbing or dipping. Effective on any metal surface.
Cutting-oil Additives	**Cresol Z-2 Cresol 2-A**	Two cutting-oil additives suitable for production of coolants, drawing compounds, and metal-rolling, forming, and extreme-pressure lubricants. They are modified sulphur-chlorides. Owing to their chemical composition, they do not stain ferrous metals, gum, nor decompose. When added to light mineral oils, a transparent liquid is obtained which permits observation of work being machined or fabricated.	Particularly adapted to the machining of Monel metal and chromium, chrome-molybdenum, chrome-nickel, tungsten, and stainless steels.
Permanent-magnet Material	**Cunico**	An alloy of copper, nickel, and cobalt that is malleable, ductile, and machinable. Magnets are furnished only in final shapes, as they are age-hardened in the manufacturing process.	Used for the manufacture of small magnet screws and the punching of intricate magnet shapes.
Permanent-magnet Material	**Cunife**	A copper-nickel-iron alloy having the physical properties of Cunico; must be magnetized only along direction of cold-working to obtain highest magnetic quality.	A wide variety of magnet designs can be obtained by forming, punching, or machining to shape.
Silicone Oils	**DC 710 DC 710G DC 710R**	New silicone oils especially adapted for high-temperature lubrication and providing heat stability to 500 degrees F., resistance to oxidation, freedom from gumming, low volatility, water repellency, and good lubricating properties at medium to light loadings.	DC 710 is adapted especially for high-temperature lubrication. Can also be used as high-temperature bath liquids and as high-temperature hydraulic fluids. DC 710G provides excellent lubrication and protection for mechanisms continually exposed to heat, high humidity, or to the atmosphere. DC 710R permanently lubricates such sealed-in precision devices as clocks and instruments.
Silicone Resin	**DC 804**	A thermosetting silicone resin which can be used in formulating paints having exceptionally high heat and moisture resistance and a hard mar-resistant surface. This resin also has a high resistance to oxidation, ozone, and ultra-violet radiation.	Especially suitable for producing white finishes having properties between those of ceramic coatings and ordinary organic paints.

Review of Some Recently Developed Materials — Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
High-density Alloy	**Dense Alloy No. 112**	An alloy composed largely of tungsten, with some cobalt, nickel, silver, and copper added. Has a density of about 0.620 pounds per cubic inch (about one and one-half times that of lead). It is machinable, and can be brazed or soldered.	Has been used in balancing weights where space is of prime importance.
Pre-lubrication Compound	**dgf-123**	A dispersion of synthetic colloidal graphite in alcohol and carbon tetrachloride. Rapid evaporation of liquid carrier leaves dry protective coating of graphite.	As a pre-lubricant, it serves dual purpose of reducing surface tension to permit retention of thicker film of oil and of acting as a wetting agent to distribute oil film. Also serves as temporary lubricant in case of failure of oil supply.
Water-repellent Material	**Dri-Film**	A water-repellent material which forms a continuous insulating film over glass.	Fluorescent lamps, even with metal reflectors, when coated, are practically insensitive to high humidity. Also used for treating ceramic radio insulators.
Silver Brazing Alloys	**Easy-Flo 35** **Easy-Flo 45**	Silver brazing alloys featuring low silver content. Easy-Flo 35, containing 35 per cent silver, has a melting range of from 1115 to 1295 degrees F., and is free flowing at a very low temperature for its silver alloy content. Easy-Flo 45 has a melting range of 1120 to 1145 degrees F.	Easy-Flo 35 is suitable for producing joints between ferrous or non-ferrous metals which are high in strength and ductility. Easy-Flo 45 is particularly applicable where a lower working temperature range is called for.
Solvent Cleaner	**EC-75**	An emulsifiable solvent cleaner that will not harm alkaline cleaners. As a penetrating solvent, it is used undiluted to replace naphtha, kerosene, and chlorinated solvents.	Suitable for removing oil, buffing compounds, and other organic dirt, a swell as solid dirt, from all types of metals.
Bottom Boards	**Edco Dorometal**	Magnesium boards which eliminate burning, warping, splitting, and loose joints that cause mold shifts, breaks, and cracks. Unharmed by normal run-outs and spills.	For use in foundries to hold flasks when pouring and molding sand castings in ferrous and non-ferrous metals.
High-speed Steels	**Electrite MV**	A line of high-speed steels, distinguished by chromium, molybdenum, and vanadium content, with absence of tungsten.	Well adapted for applications not requiring full properties of more common tungsten-bearing high-speed steels. May be used for small drills and reamers, thread chasers, taps, woodworking knives and cutters, and body stock for carbide-tipped tools.
Aluminum Brazing Flux	**Elite**	Properties that make possible the use of Airco No. 26 welding wire for brazing 2S, 3S, 53S, and 61S aluminum.	For aluminum brazing.
Acid Inhibitors	**Enthone No. 9**	A liquid inhibitor that readily dissolves in acid solutions. In both hydrochloric and sulphuric acids, the inhibiting action is over 90 per cent, and in some cases as high as 98 per cent. Dissolves without sludge or residue.	Particularly useful where exhaust ventilation is not available. Suitable for use in both cold and hot pickles. Steel coated with scale, oxide, and rust can be quickly pickled without attack upon the base metal.
Synthetic Adhesive	**Fairprene No. 5118**	A thermoplastic synthetic elastic composition that does not require vulcanization to obtain maximum adhesive strength. Is weakened only slightly by oils or straight gasoline. Is unaffected by temperatures as low as 40 degrees F., but is weakened at 160 degrees F. up. Full bond strength is regained after cooling.	Recommended for bonding Buna-N type synthetic rubbers and vinyl films or sheet stocks to rigid surfaces, such as steel, aluminum, glass, wood, or concrete.

Review of Some Recently Developed Materials — Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Cutting Oil	**Ferox**	A water-soluble cutting oil which also acts as a rust preventive. No soaps or alkalies are used to keep the cutting oil in suspension, so that the solution remains clear.	For use in machining operations wherever a water-soluble cutting oil is called for.
Cleaning Compound	**Ferrex**	A non-inflammable hot tank cleaner that effectively removes carbon and paint, as well as grime, grease, gums, heat-hardened resins, and heavy dirt.	For use on steel, cast iron, bronze, copper, and red brass.
High-temperature Insulation	**Fiberglas**	A group of light-weight insulating materials composed of glass filaments which will withstand temperatures up to 1800 degrees F. Designed for industrial, marine, and aircraft applications.	Suitable for insulating housings and flange covers of high-temperature steam turbines, as well as exhaust manifolds and turbo-supercharger housings on oil- or gas-fired supercharged four-cycle Diesel engines. In some applications, provides a removable insulation that can take the place of refractories. Fiberglas is also adapted for use as a filtering element in fly ash separators.
Insulating Material	**Flotofoam**	A plastic foam insulating material that combines exceptionally low thermal conductivity with very light weight. The material is non-corrosive, non-toxic, and self-extinguishing.	As thermal insulation for low-temperature installations.
Wire Solder	**Fluxrite**	A wire solder with flux in four closed grooves along the outside surface to insure a rapid even flow.	For general soldering operations.
Wire Stripper	**Formula 21**	A non-corrosive, non-inflammable liquid for removing wire coatings.	Application is by dipping the wire in the liquid. Coating is then wiped or blown off.
Degreaser	**G-Bex D**	A neutral emulsifying solvent having a minimum flash-point of 165 degrees F. Is not irritating to the skin, and is non-corrosive to all standard construction metals. Forms slight protective film after washing.	For light- or heavy-duty degreasing by spray, brush, or soak application followed by water rinse. Will hot-strip paint or lacquer.
Sintered Alloy	**G-E Hevimet**	An alloy of tungsten, copper, and nickel having a density 50 per cent greater than lead. Combines greater tensile strength with good machinability and is highly resistant to corrosion. Is easily plated with cadmium, chromium, and nickel, and can be silver-soldered or brazed by standard methods. The new alloy can be obtained in a variety of non-porous sheets and blocks.	Applicable to the design and construction of moving parts possessing maximum inertia and minimum size such as balance weights for crankshafts, air screws, centrifugal clutches, and other rotating parts.
Soldering Compound	**Galvalloy**	A soldering compound for aluminum and magnesium soldering applications. Withstands corrosive action of degreasing vapors.	After tinning a magnesium surface with this compound, pure zinc, ordinary solder, or pot metal can be used as a filler or a soldering agent.
Vinylite Finish	**High Solids Vinylite Finishes**	The resistance of Vinylite plastics and the adhesion, depth, gloss, and workability of synthetics are combined in this new series of finishes. They are adaptable to baking and produce brilliant finishes with a high degree of durability on interior and exterior surfaces.	Can be applied to both ferrous and non-ferrous metals by any method of metal product finishing, either before or after fabrication.

Review of Some Recently Developed Materials — Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Cleaning Compounds	**Houghto-Clean 200 Series**	A series of seventeen different cleaning compounds, including cleaners for maintenance work and electrolytic and special-purpose compounds. New synthetic detergents have been utilized, as well as new alkalies that have become available as a result of wartime research.	For a wide range of ferrous and non-ferrous metal cleaning applications.
Infra-red and Ultra-violet Filter	**Infropake**	A plastic material that transmits approximately 84 per cent of visible light with practically no ultra-violet transmission between 200 and 400 milli-microns and about 15 per cent infra-red transmission between 750 and 1500 milli-microns.	For use in industrial goggles and windows to protect eyes from harmful infra-red and ultra-violet radiations.
Chromate Coating Process	**Iridite Bright**	Applied by immersion in water solution after plating operation to provide protection against handling and tarnishing.	For application to zinc- or cadmium-plated parts.
Rust Preventive Compound	**Kano Rustproof**	A liquid compound applied cold by dipping, spraying, or brushing. Forms a tough, flexible, and non-porous surface that prevents rust on polished surfaces due to handling. Is readily removed by any petroleum solvent.	For protecting tools and machine parts.
Carbide Extruded Rounds	**Kennametal (in Extruded or Centerless-Ground Form)**	Rough extruded or centerless-ground rounds in two straight tungsten-carbide grades—KE5 and KE7—with Rockwell A hardness of 90.0 and 91.0, respectively.	Developed for use as wear-resistant elements such as guides, feeding fingers for automatic machines, rollers, guide rails, laps, scribers, points for engraving tools, thread checking wires, etc.
Plastic Coating	**Liquid Coating**	A plastic coating to minimize or eliminate scratches, die marks, and other surface defects on stainless-steel sheets. Also acts to reduce power requirements in deep-drawing operations.	Is particularly effective during stamping, drawing, and forming operations. Can be applied by brushing, spraying, or dipping, and is readily removed by stripping.
Polystyrene Treatment	**Logoquant**	A treatment for the surface of polystyrene parts which provides a high mar resistance. Also produces a surface that is considerably less electrostatic than untreated polystyrene and that resists solvents, such as gasoline, mineral oils, carbon tetrachloride, and toluene.	Fully developed for production-line application either by spraying or dipping without special equipment or curing.
Stainless Clad Steels	**Lukens**	A complete line of stainless clad steels consisting of Type 304, 316, 347, 410, or 430 stainless steel bonded to a backing plate of carbon or low-alloy steel.	For customary stainless-steel applications requiring corrosion resistance and product protection.
Sintered Alloy	**Mallory 1000 Metal**	A sintered alloy with increased strength and a density approaching that of tungsten. Unlike tungsten, it is readily machinable. Has high resistance to atmospheric corrosion and to certain acids, making it useful for electrolytic process fixtures.	Widely applied in making balancing components in rotors for such devices as gyro-pilots and governors. Its high modulus of elasticity and high density and tensile strength make it useful for heavily stressed parts. Also useful for radium containers.
Ground Flat Stock	**Marshall**	A ground flat carbon tool steel furnished in a form that practically eliminates cutting to size, shaping, planing, and finish-grinding. It is fully annealed for easy machining, and can be heat-treated by standard procedures.	Suitable for such products as templets, models, dies, jigs, shims, and gages.

Review of Some Recently Developed Materials — Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Abrasive Disk Cement	**Master**	A cement with uniform high adhesive properties that helps to insure grinding accuracy.	For applying cloth-backed and flexible paper abrasive disks to steel-disk grinding machines.
Metallizing Wire	**Metco-Weld H**	A metallizing wire composed of a powdered hard-facing alloy extruded with a plastic binder. Permits application of smooth, uniform, relatively thin, hard coatings possessing high resistance to abrasion and corrosion.	Is applied by spray gun which volatilizes the plastic binder, leaving a purely metallic deposit. Subsequent fusing is obtained with a torch or an attachment to the metallizing gun.
Molding Alloy	**Moldaloy**	An alloy that melts at 430 degrees F.; has a hardness of 22 Brinell; a compressive strength of 8000 pounds per square inch; a tensile strength of 11,500 pounds per square inch; and a shrinkage of approximately 0.001 inch per inch.	Recommended for molds for casting low-temperature melting plastics; rubber molds; wax molds for precision casting; models for engraving machines; master patterns; forming dies for thin sheet metals and thermoplastics; proof casting of molds; and chuck jaws for holding irregular pieces.
Emulsifying Agent	**Mulsirex**	An emulsifying agent designed for use with kerosene and other petroleum cleaning agents to insure greater safety, efficiency, and economy. Its emulsifying characteristics make foreign substances readily soluble in water, facilitating cold-water rinsing.	Recommended for removing very heavy deposits of oil and light grease from all kinds of metal parts and equipment.
Inoculating Alloy	**Nisoloy**	An alloy containing approximately 60 per cent nickel, 30 per cent silicon, and 10 per cent iron, with a low melting point and relatively high specific gravity.	Used as an inoculating alloy for gray iron to improve its machinability. The alloy penetrates and diffuses rapidly through the melted metal.
Metal Cleaning Compound	**No. 101A**	A medium-duty alkaline cleaner that includes special water-softening materials and inhibitors to prevent attack on metal.	Particularly effective for removing dirt, grease, and oil. Especially designed for cleaning aluminum. Can also be used as a soak cleaner for non-ferrous metals, such as zinc, brass, bronze, pewter, etc.; in this case, the work is made the cathode and cleaned electrically.
Plating Rack Coating	**No. 266**	An air-drying rack coating that is resistant to all plating solutions, including hot alkaline cleaners; adheres well to all surfaces, and is flexible and resilient.	For the production of electroplating racks. Can be applied to required thickness in two dips and needs only twenty to thirty minutes' drying time.
Tool Steels	**No. 610** **No. 484** **Vega** **T-K** **No. 883**	No. 610 is recommended when extreme wear resistance and good toughness are needed. No. 484 is for tools requiring an ideal combination of wear resistance and toughness. Vega is intended for tools requiring extreme toughness with good wear resistance. T-K combines greater hardness with improved toughness. No. 883 offers extreme toughness and greater red-hardness.	Part of a new and improved set of matched tool steels. Three air-hardening tool steels for applications where minimum distortion in heat-treatment and elimination of hardening hazards are essential, and two new steels having greater hardness and toughness at high temperatures.
Industrial Adhesive	**No. 4665**	A tough, flexible adhesive that requires no catalyst or special preparation for use. Can be applied without thinning by brushing, roller coating, knife coating, or dipping. Dried film is resistant to dilute alkalies, acids, and corrosive salt solutions. Also resistant to mildew and fungi.	Suitable for bonding metal foils and metal sheets to wood; plastics; vulcanized synthetic, and natural rubber; as well as to other substances having widely different coefficients of thermal expansion.

Review of Some Recently Developed Materials — Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Plastic Adhesives	**Nos. 12507 and 12508**	Two modified phenolic liquid adhesives which, when properly cured, exhibit high shear and tensile strengths and exceptional resistance to water, gasoline, kerosene, and mineral oils. Designed for cementing metals, thermosetting plastics, wood, fabric, or any combination of these.	Especially useful for cementing metals and laminates; preparing metal-faced, sandwich type construction; attaching brackets and lugs to thin metal sheets; and constructing trailer walls, airplane fuselage walls, and walls of prefabricated housing.
Graphitic Alloy Steel	**No. 91140**	A graphite alloy steel containing free graphite, as well as carbides. Has improved machinability and freedom from scuffing and scoring. Can be heat-treated, with a minimum of distortion, to obtain a wide range of physical properties.	Suitable for use in such applications as engine lathe ways, spindles, pump parts, and pneumatic hammer parts.
Steam Cleaning Detergent	**Oakite No. 92**	A heavy-duty alkaline type detergent which gives thorough and fast steam-cleaning action at low concentrations. Prevents scale clogging in steam coils, is readily dissolved in hot water, and gives off no offensive fumes or toxic vapors.	For use in modern steam guns and coil type steam generating mechanisms. For cleaning machinery and equipment parts preparatory to repair and overhauling; preparing equipment surfaces for repainting and refinishing; cleaning equipment too large for tank immersion; and for paint stripping and other cleaning operations.
Pickle Control	**Oakite Pickle Control No. 3**	Improves pickling cycle and results in less fuming, hydrogen embrittlement, pitting, and discoloration of work. Also minimizes frequency and cost of spent liquor disposal.	For use in inhibiting hot sulphuric-acid pickling solutions. Can also be used in mixed sulphuric-hydrochloric acid baths in which sulphuric acid predominates.
Protective Coatings	**P-5**	A series of coatings having high resistance to moisture, acids, and alkalies. Are free from objectionable odors, non-toxic, and have good thermal stability, high resistance to abrasion and scrubbing, and good aging characteristics.	Developed for industrial use, particularly in the protection of metal, wood, and concrete.
Prepainting Solution	**Paint Bond**	A simple, fast, and economical method of preparing aluminum and its alloys for painting or lacquering.	Any alloy of aluminum can be so prepared by spraying, brushing, or dipping.
Metal Cleaners	**Parco**	A series of metal cleaners for steel, zinc, and aluminum, including emulsion, acid, and alkaline types.	Specialized cleaners to meet varying conditions. Are formulated to make hard water suitable for cleaning; rapidly remove soil from metal surfaces and prepare them for fine, dense Bonderite coatings; and remove rust prior to painting.
Protective Coating	**Peelcote**	A vinyl-base protective coating applied by spray or dip and providing a clear transparent or a black opaque coating.	Designed to protect metal surfaces from scratches, chips, and corrosion during shipment, storage, and handling.
Metal Cleaners	**Pennsalt Cleaner A-22 and PM-95**	Pennsalt Cleaner A-22 is a general-purpose soak tank cleaner.	For cleaning aluminum before anodizing, chromodizing, phosphatizing, and other prepainting treatments, and before deoxidizing and subsequent spot-welding.
		PM-95 is an acid-base cleaning and descaling compound.	For cleaning and descaling ferrous metals, especially for the removal of oxides resulting from heat-treating or annealing.

Review of Some Recently Developed Materials — Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
General-purpose Cleaner	**Pennsalt MC-1**	A dry granular material that dissolves quickly in water for general-purpose cleaning.	Applications include cleaning of walls, floors, woodwork, and windows; industrial washing machine use; steam-gun cleaning of painted or unpainted surfaces; tumble barrel cleaning; and burnishing and deburring operations.
Protective Coating	**Permacote**	A transparent liquid skin readily applied by brushing, spraying, or dipping. Forms a tough transparent coating, which remains flexible and is resistant to extremes of heat or cold.	Applicable to metal, wood, leather, and fabric surfaces. For protection against corrosion and deterioration.
Underprimer	**Perma-Skin**	A quick drying, anti-corrosive underprimer combining metal surface treatment with high anchorage of top coats and excellent adhesion. On ferrous surfaces, corrosion is inhibited by phosphatization and action of contained pigments.	Suitable for use on such metals as cold-rolled steel, aluminum, nickel, copper, and stainless steels. Can be used as primer for practically all conventional finishing materials, such as paints, baking enamels, lacquer, etc.
Magnetic Alloy	**Permenorm**	An alloy of nickel and iron which becomes highly magnetized when placed in an electrical field.	For use in electrical amplifiers and rectifiers.
Protective Coating	**Phenoglaze**	A phenol-formaldehyde protective coating that provides a plastic film impervious to heat, moisture, and corrosive action.	Applicable to all types of wood and metal products.
Protective Coating	**Plastipak**	A coating that provides protection from moisture, acids, and alkalies. Forms a tough, elastic transparent or colored film. Adheres tenaciously, but is easily stripped off in a continuous sheet.	Has been applied successfully to cutting tools, gears, drills, taps, sheet metal, as well as to wood products, glass, and porcelain.
Synthetic Casting Resin	**Plastitool**	High-strength phenolic that is free from air bubbles after casting. It is hardened or cured by means of a catalyst and heat.	Specially adapted for plastic castings where trouble has been experienced with air bubbles.
Plastic Dyes	**Poly Supra Concentrate Molding Powder Dyes**	Powder dyes that give clear and transparent color effects. Variation in depth of color controlled by amount used. Available in red, royal blue, blue-green, orange, amber, purple, black and yellow.	For addition to cellulose-acetate, polystyrene, Lucite, Plexiglas, and vinyl molding powders.
Arc Welding Compound	**POM**	An improved arc-welding compound that supplements fluxing action of welding rod coating. It stabilizes and quiets the welding arc, prevents arc interruption, improves finish, and precludes scale on both sides of weld bead. Also prevents adhesion of weld spatter.	Is applied by brushing or spraying into the seam to be welded and on adjacent surfaces where spatter usually collects.
Porcelain-like Finish	**Porcelanite**	A semi-glazed finish that protects iron or steel surfaces to which it is applied. Prevents scaling of metal when subjected to high heat and reduces corrosive action of gases, flue dust, and slag in furnaces.	For protecting cold-rolled and cast-iron burning racks, burning tools, iron and glass furnace interiors, ladle linings, etc.
Prepainting Solution	**Prepaint**	A material that reacts chemically to bond with aluminum surfaces in from fifteen to sixty seconds after application. Paint or lacquer is applied immediately after this preparation with improved adhesion and uniformity of coverage.	For application to aluminum or aluminum-alloy products that are wrought, cast, die-cast, machined, forged, or extruded.

Review of Some Recently Developed Materials — Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Protective Coating	**Redskin**	A protective liquid-plastic coating for polished or bright metal. Applied by spray, brush, or dipping. Dries quickly, forming a tough elastic film impervious to corrosive action or normal handling.	For the protection of highly finished metal surfaces.
Contact Cleaning Compound	**Rotol**	A liquid compound that cleans all forms of electrical contacts. Eliminates need to use sandpaper or other forms of abrasive for cleaning purposes.	Can be applied to surfaces of commutators, slip rings, and contact tracks of motors, controllers, starters, regulators, and other electrical equipment.
Rack Coating	**RX-2500**	A white opaque and glossy coating that is unaffected by hot alcoholic reverse-current cleaners and such oxidizing agents as chromic acid and 40 per cent nitric acid. Has high resistance to organic solvent cleaners.	For application to electroplating and pickling racks.
Bar Steel	**Ry-Ax**	An improved, heat-treated, carbon-manganese, hot-rolled bar steel with greater tensile strength, better machining qualities, and a higher fatigue limit.	Particularly recommended for special heavy-duty shafting such as is used in cranes, armatures, machine tools, and coal-cutting machines.
Enamel Stripper	**S-45**	A slightly viscous liquid that can be brushed, sprayed, or applied by dipping. Contains an evaporating retardant to prolong stripping action. Causes enamel to wrinkle, so that it can be readily brushed, wiped or scraped off.	Recommended for large parts that cannot be immersed in a stripping solution. Acts rapidly on most synthetic enamels, as well as certain nitro-cellulose coatings. Not satisfactory for linseed-oil paints, phenol-formaldehyde enamels, or vinyl type coatings.
Plastics	**Selectron**	A series of highly versatile plastics developed for wartime radar and aircraft applications, now available for a wide range of peacetime uses. Within limits, the resins are being made to specifications individually designed to meet customers' particular requirements.	Applications include laminating, impregnating, casting, molding, and use as adhesives.
Permanent-magnet Material	**Silmanal**	This material has a high intrinsic coercive force. It is ductile and malleable, and can be punched, machined, rolled, or ground.	Useful in instruments where service in strong electrical fields is required.
Die Steel	**Speed-Cut**	A free-machining die steel that permits hardening prior to machining. Is said to machine as readily at 300 Brinell as other steels used for similar purposes in the annealed state.	Particularly adapted for plastic molds and for die-casting dies for white-metal alloys.
Protective Oil	**Special Protective Oil**	A semi-permanent rust-preventive oil of low viscosity, which imparts a film to ferrous surfaces that resists moisture, humidity, perspiration, and acid fumes. Disperses water on metal surfaces.	For surface protection of ferrous parts.
Protective Compound	**Spray-Peel**	A plastic compound, applied by brushing or spraying, that dries to a rubbery film, insuring a moisture-proof seal that is resistant to abrasion, salt water, aromatic spirits, and oils, alkalies, and acids.	For over-all product protection. Can be readily removed by stripping.
Greases	**Starfak L, M, and H**	Greases with improved oxidation and heat resistance and better low-temperature characteristics.	For general applications wherever these greases have been called for.

Review of Some Recently Developed Materials — Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Ground Flat Stock	**Starrett**	Two types of precision-ground flat stock. One is spheroidized-annealed and has fine grain structure and deep hardening characteristics suitable for precision parts requiring accuracy of size after hardening. The other is a high-grade tool steel, annealed for easy machining, which develops maximum hardness when quenched.	Designed to expedite production of precision parts and pieces, such as die parts, flat gages, drill jigs, templets, machine and fixture parts, and other small parts having two flat parallel surfaces.
Corrosion Inhibitor	**Steelyfe 11**	A thin, dark liquid having a flash point of about 105 degrees F. Upon evaporation, it leaves a soft, transparent coating which has high corrosion-preventive properties. Is readily removed by wiping or by the use of degreasers.	Applied to steel and other ferrous metals by dipping, brushing, or spraying.
Soldering Alloys	**Super Solder**	A series of soldering and brazing alloys in paste form containing a cleaning agent, flux, tinning agent, and solder. After application, only heat is necessary to establish strong joints.	Can be applied with spatula, brush, or from a collapsible tube. Adaptable for semi- and fully-automatic methods of application.
Concrete-floor Repairing Compound	**Swift-Floor**	A compound containing no asphalt, cement, or gravel that sets by compression rather than by water evaporation. It does not crack, crumble, or curl, and can be rolled to a feather edge.	For repairing concrete floors.
Drawing Compound	**Texaco No. 2**	A drawing compound with pastelike consistency that is easily washed from a completed piece with water.	Particularly adapted for use in stamping and drawing operations.
Water-repellent Grease	**Texaco Star Grease No. 0**	A grease made with lime soap that is heat-stable, water-repellent, and non-separating.	For factory lubrication of tractor track rollers and similar applications.
High-frequency Resistant Plastic	**Textolite No. 1422**	A plastic material possessing a very low power factor with an ASTM heat distortion of 105 to 113 degrees C. Can be machined on automatic or semi-automatic equipment.	Particularly suitable for ultra high-frequency insulating applications. Being a cast plastic, is applicable to small-quantity production.
Packaging Compound	**Thermo-dip N S**	A low-cost, hot-melt compound that is transparent and pale amber in color. It is readily removed by stripping; can be used repeatedly; and maintains its flexibility over extended periods.	For protecting machine tools, gears, and various metal parts from corrosion, abrasion, and the hazards of shipping and handling.
Spray-booth Compound	**Triad PRD**	A light-colored, semi-liquid material applied to spray-booth walls with brush or spray gun. Forms a continuous white coating to which paint overspray adheres. Is readily scraped off without previous soaking or can be easily removed by flushing with either hot or cold water.	Can be used for walls of either wet or dry spray booths, but is especially advantageous for use on dry booth walls.
Solder	**Tri-Core-Leakpruf**	A solder with a triple core of synthetic acid flux that is more active but less corrosive than the usual acid fluxes.	For use in soldering all metals except aluminum and magnesium.
Rack Insulator and Protective Coating	**Tygoflex Rack Coating**	A coating that, after being applied by dipping, spraying, or brushing, is subjected to heat for a short period to convert it to a thick, impermeable insulator resembling a black rubber compound of medium hardness. Is resistant to all plating-acid or alkaline solutions at temperatures up to 250 degrees F. Unaffected by abrupt temperature changes.	As a protective insulator on electroplating racks and process equipment.

Review of Some Recently Developed Materials — Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Organic Coating	**Ucilon**	An organic coating material especially formulated to provide high resistance to a wide variety of corrosive conditions. Is resistant to acids, alkalies, and salts, and is unaffected by oils, gasoline, and alcohols, including vegetable and fish oils, commercial alcohols, lubricating oils, greases, and other petroleum derivatives.	For application wherever protection against corrosion is desired. Will adhere firmly to properly prepared metal, wood, and concrete surfaces.
Carburizing Steels	**U.S.S. SuperKore**	A series of four improved carburizing steels having a hardenability equal to or greater than more highly alloyed grades in common use. They also maintain high core strength and develop the toughness necessary for heavy-duty applications; have improved carburizing characteristics; are easier to anneal; and have increased machinability.	Suitable where deep-hardening steels that can be easily machined into gears, shafts, and pinions for equipment subject to heavy-duty service are required.
Permanent-magnet Material	**Vectolite**	The first non-metallic, non-conducting magnet material to be produced. A hardened, sintered combination of iron rust and cobalt oxide, mixed in powder form. This material has high resistance to demagnetized forces.	Applied where extremely light, non-conducting magnets are advantageous.
High-speed Steel Rounds	**Vee-Oginized Steel**	High-speed steel rounds produced by a process that insures centers free from carbide segregation.	For usual applications of high-speed steel rounds.
Thermoplastic Material	**Versalite**	A thermoplastic material that is tough, light, and easy to form into compound or irregular shapes. Can be formed with a solid color throughout and with a dull, satin gloss or embossed finish. Will not chip or warp, and is highly resistant to gasoline, oils, and most commercial cleaners.	Possible applications include radio cases and parts for boats, automobiles, busses, airplanes, and trains.
Refractory Coating	**Vitroseal**	A refractory coating that prevents spalling action, resists heat penetration, and decreases carbon slag and clinker adherence. Forms a semi-glazed, protective monolithic wall of from 8.5 to 9 Mohs hardness scale, and is impervious to heat up to 3390 degrees F. Withstands destructive effects of flame impingement and abrasion.	Applied over firebrick in fireboxes, furnaces, and crucibles by brush or spray.
Prepaint Surface Conditioner	**Wash Primer**	A metal surface-conditioning agent that replaces the customary inhibitive wash coat. Acts also as priming coat, which gives temporary protection before painting. Overcomes difficulties previously experienced with surface-conditioning coatings, such as freezing, non-uniform deposit, and poor water resistance.	Provides excellent adhesion with fair degree of flexibility when applied to steel, aluminum (anodized and unanodized), tin, galvanized iron, stainless steel, and similar metals.
Wood Glue	**Wood-Lok**	A cold-run fast-setting resin wood glue that requires no heating. It can be handled and machined after twenty to thirty minutes' clamping time. Produces a strong, resilient bond that is unaffected by humidity.	Especially developed for wood joint assembly operations.
Anti-corrosive Process	**Zincilate**	A process for coating ferrous metals which is said to provide twenty years' protection against all common types of corrosive action. Only one coat is needed, and this has high abrasion resistance.	Has been used successfully on pipe lines, on the interiors and exteriors of water and gasoline tanks, on bridges, machine parts, and marine installations.

Engineering News

Studying Mechanical Properties of Human Bones

Because of the numerous shocks and impacts sustained in high-speed aircraft flights, as well as those occurring in accidents, it has become increasingly important to develop safety devices for the protection of the human body. With this end in view, a study is being conducted by the Naval Medical Research Institute in conjunction with the National Bureau of Standards on the mechanical properties of human bones. Data to be used in the design of these devices is being collected for the prediction of body behavior under impact loads, such as are encountered in aircraft crashes, seat-ejection from aircraft, parachute opening, and exposure to blast.

Wright to Test Lockheed Axial-Flow Turbo-Jet Engine

To expedite the development of the 5000-pound thrust aviation gas turbine designed and built by the Lockheed Aircraft Corporation, the United States Air Forces have awarded the Wright Aeronautical Corporation a contract for testing and evaluating the performance of the engine. Because of its projected low fuel consumption, this turbo-jet engine is of particular interest in the jet-turbine field. Consisting of an axial-flow compressor and turbine, it can be applied as a pure jet engine or as a turbine propeller power plant. Its small frontal area is said to facilitate installation in either the wings or the fuselage of planes.

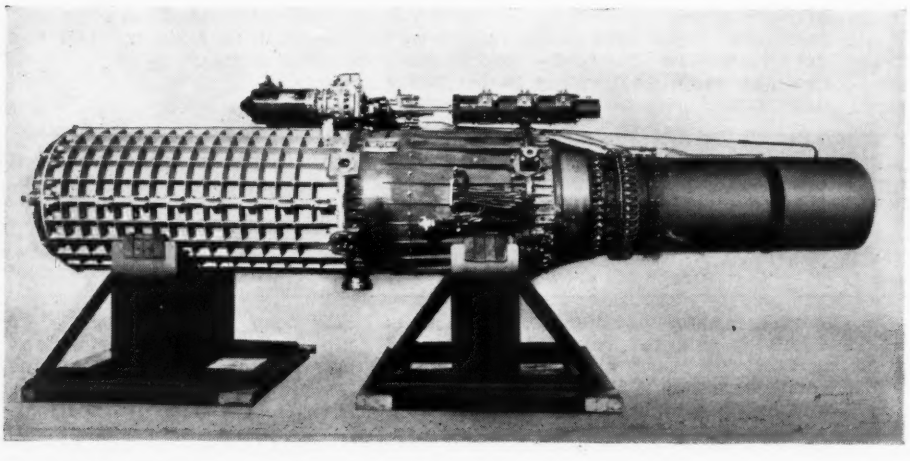
Magnetic Sweeper Picks up Steel and Iron Chips from Shop Floors

A sweeper equipped with a permanent plate magnet, mounted on wheels so that it can be pushed over the floor or ground of industrial plants for picking up iron or steel particles, has been developed by the Dings Magnetic Separator Co., Milwaukee 14, Wis. The permanent, non-electric magnet is equally effective on wet and dry surfaces; in fact, the sweeper can be used completely submerged in water.

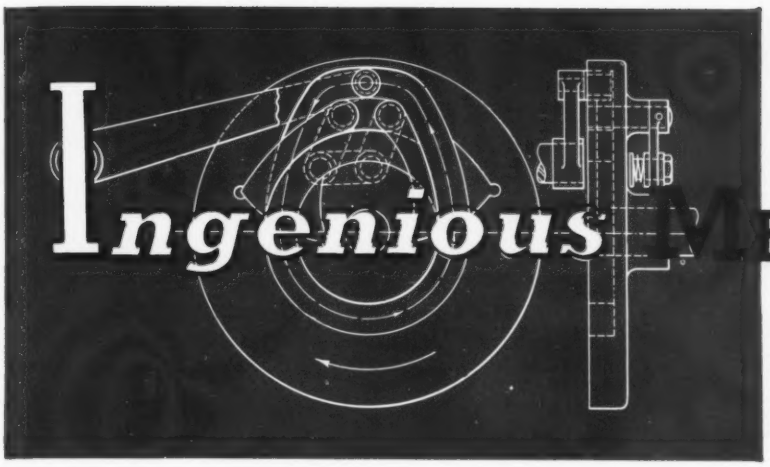
In the operating position, the magnet rests on a horizontal non-magnetic wearing plate, to which the iron and steel are attracted and firmly held. To clean, the operator lifts the lever on the handle, raising the magnet from the wearing plate and allowing the iron to drop off. The sweeper is capable of picking up 10 to 20 pounds of chips or 40 pounds of plate in one load.

Pressurized Smelting May Increase Iron and Steel Output

Smelting of iron ore under pressure has been performed successfully in two converted blast furnaces at Cleveland and Youngstown, Ohio. In this process, the smelting furnace is partially sealed by a system of valves, so as to prevent the free escape of the hot gases into the air. This causes atmospheric pressure to be built up within the furnace, which results in higher temperatures and thus speeds up the chemical processes of smelting. Another advantage indicated is the utilization of low-grade ores.



Lockheed New Turbo-jet Engine with Low Fuel Consumption, which will be Tested by the Wright Aeronautical Corporation



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

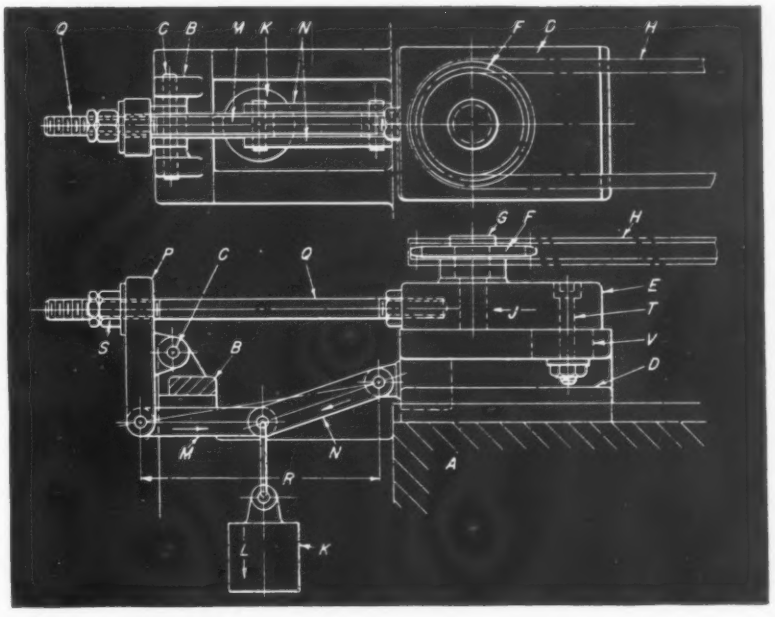
Mechanism for Taking Up Slack in Sprocket Chain

By F. SERVER

A mechanism employing a weight-and-lever arrangement for taking up slack in a sprocket chain and for keeping the chain tight while it is in operation is shown in the accompanying illustration. On the non-movable base *A* is mounted a bracket *B* carrying a short shaft *C*, which supports a hinged lever *P*. Slidably mounted on the base is a unit *D* which carries the adjustable plate *E*. This plate supports the idler sprocket *F*, which is free to revolve on stud *G*. The function of the idler sprocket is to continuously exert sufficient pull on the sprocket chain *H* to keep it tight.

The cast-iron weight *K*, which exerts a pull in the direction indicated by arrow *L*, applies a pulling action to the connecting links *M* and *N* in the directions indicated by the arrows. This action transmits a compound movement to the hinged lever *P*, pulling back on rod *Q* and exerting sufficient pull on slide *D* to keep the chain *H* tight. It will be noted that the tendency of the weight to shorten the distance *R* as lever *P* pivots about the short shaft *C* causes the upper end of lever *P* to be forced to the left against the adjusting nut *S* on the thread at the outer end of rod *Q*.

Plate *E* is adjustable on slide *D* and permits periodical adjustment to take up any major slack which may develop in the chain. Four screws of the type shown at *T* hold the plate in position, while the slide *D* is provided with an elongated slot *V* which permits adjustment of plate *E*. Adjusting nut *S* on rod *Q* permits setting the mechanism so that weight *K* will be in its most effective position for holding the chain under the tension required to take up the slack in the sprocket chain.



Weight-actuated Mechanism Developed to Take up Slack in Sprocket Chain by Maintaining the Required Pull on an Idler Sprocket

Obtaining an Intermittent Motion from a Uniformly Reciprocating Slide

By L. KASPER

In tooling a wire-forming machine for a certain job, it became necessary to have a uniformly reciprocating vertical slide intermittently actuate a horizontal slide. The horizontal slide was to finish one-half of its cycle in each complete cycle of the vertical slide. This was accomplished by means of the mechanism shown in the accompanying illustration.

Slide *A* reciprocates uniformly in a vertical plane, carrying lever *B*, which is free to swing about stud *K*. At the lower end of the lever is a pin *C*, which enters a recess milled in fixed member *D*.

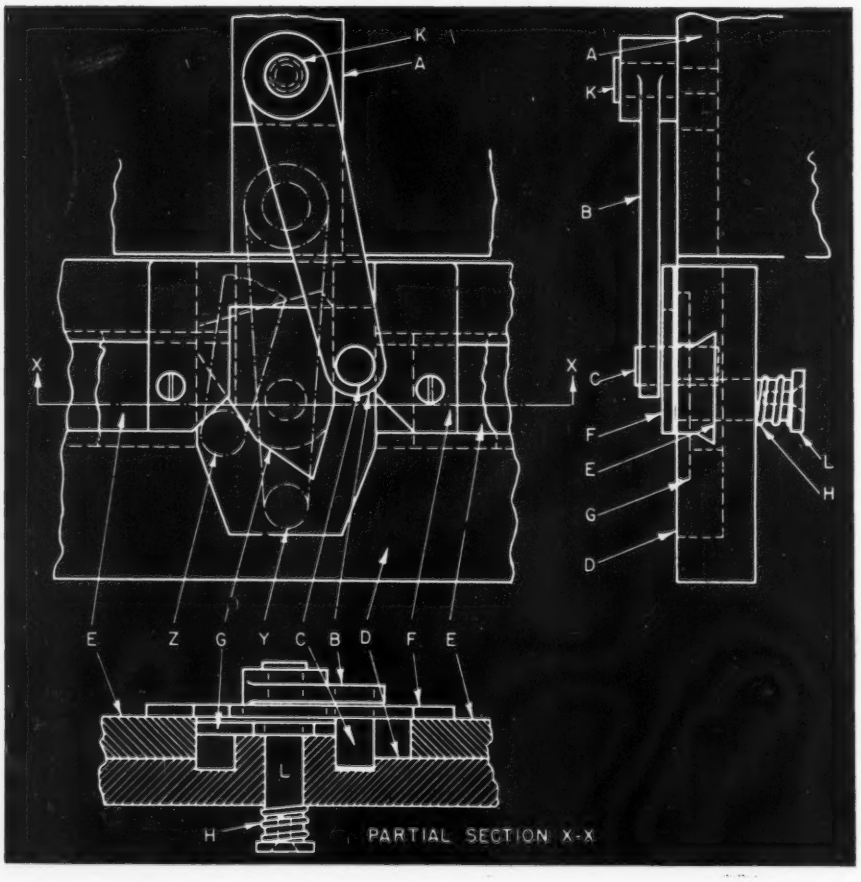
Horizontal slide *E*, which consists of a right- and a left-hand section, is free to reciprocate in ways provided in member *D*. The two sections of this slide are connected by plate *F*, which serves as a cam to produce the required motion. Rocker cam *G* can be swung about stud *L*, within member *D*, against light frictional resistance created between the under side of the rocker cam and member *D* by spring *H*.

As shown, vertical slide *A* is in its uppermost position and horizontal slide *E* is in its extreme right-hand position. At this point, the portion of pin *C* within the recess in member *D* is in contact with rocker cam *G* on one side and the cam surface of plate *F* on the other. When the vertical slide begins its downward stroke, the pin will be lowered in the groove formed between the rocker cam and member *D* until it has passed the lower end of the cam. At this point, the vertical slide completes its downward movement, and lever *B* will swing to a central position, as indicated by the broken outline *Y*.

On the upward stroke of the vertical slide, the pin will rise along the left-hand side of the rocker cam until it reaches the position indicated by broken outline *Z*. Here the pin will contact the angular cam surface of plate *F*, causing the plate and the vertical slide to move to the left.

Simultaneously, the rocker cam will be pivoted so that its lower pointed end will lie on the left-hand side of the vertical slide center line. This completes half the cycle of the horizontal slide. On the next cycle of the vertical slide, the reverse action takes place, completing the cycle of the horizontal slide as it is returned to the position shown.

Thus the horizontal slide *E* is intermittently traversed first to the right and then to the left continuously by the reciprocating vertical slide *A*.



By Means of a Rocker Cam G and Cam Plate F, Intermittent Motion of Horizontal Slide E is Obtained from a Uniformly Reciprocating Vertical Slide A

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Handy Fixture for Controlling Depth of Milling

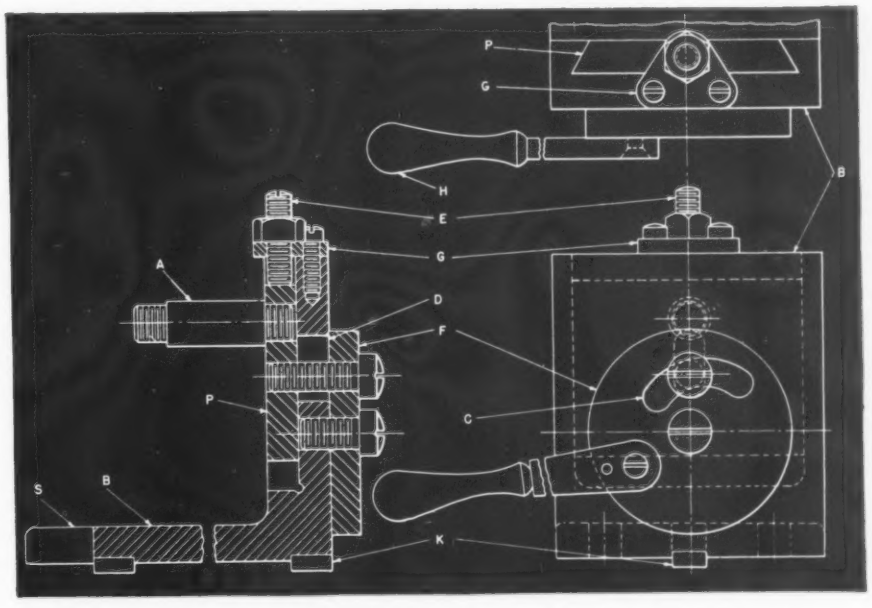
By ROBERT MAWSON, Providence, R. I.

Flats, grooves, or slots can be milled to controlled depths in such cylindrical parts as bushings, collars, or sleeves by means of the fixture shown in the accompanying illustration. Fast, easy operation and low cost are features of this fixture, which is adaptable to practically any bench or hand-operated milling machine.

The fixture consists of an angle-iron base *B*, which is fastened to the milling machine table by means of bolts placed in slots *S*. Two locating keys *K* are provided on the under side of the base to fit mating slots in the table. The vertical leg of the base is dovetailed to furnish a good sliding fit for plate *P*. An arbor *A*, which holds the part to be milled, is threaded to this plate. The work is clamped by means of a nut and washer applied to the free end of the arbor. Bushings and spacers can be made for use in fitting work-pieces of different sizes to the arbor.

A feeding plate *F* is bolted to both the sliding plate *P* and the vertical leg of the base. The central bolt-hole in the plate *F* is reamed over size to permit the plate to turn freely on the bolt. The bolt that connects the feeding plate to the sliding plate passes through a cam-shaped slot *C* in the feeding plate and a vertical slot *D* in the leg of the base.

A handle *H* is provided on the outer face of the feeding plate to pivot this plate about the bolt in its center. When the plate is thus pivoted, the upper bolt is moved up or down in slot *D* by means of the cam surfaces formed by slot *C*. The part to be milled and sliding plate *P*, to which it is clamped, move up or down with this bolt. The amount that the work can be raised or fed into the milling cutter, and consequently the depth of cut, is limited by the adjustable stop-screw *E*, which is threaded through plate *G*. This plate is bolted to the upper edge of the fixture.



Simple Fixture for Controlling Depth of Feed when Milling Flats, Grooves, or Slots in Cylindrical Parts, Such as Bushings, Collars, or Sleeves

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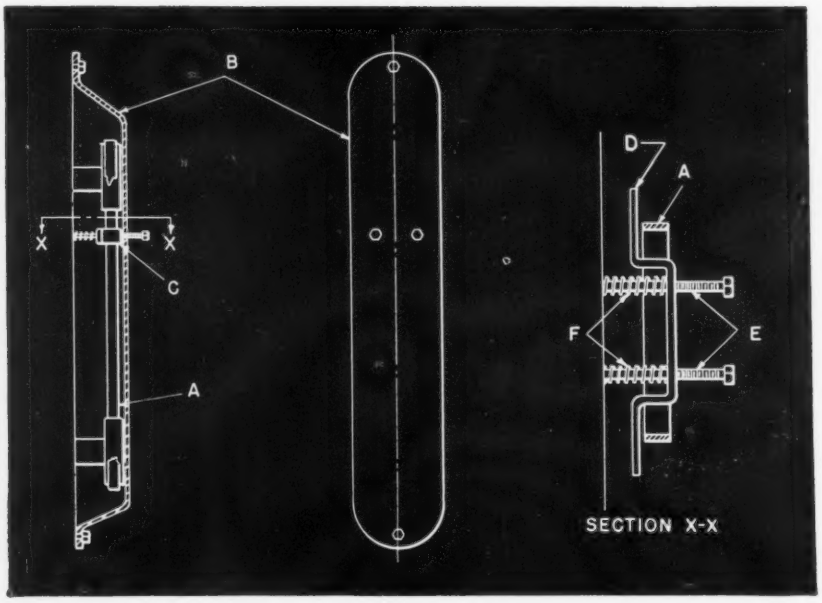
Safety Device that Insures Protection Against Unguarded Belt

By H. MOORE, Kirkstall, Leeds, England

While guards provide adequate protection against moving parts when they are in place on the machine, it is a common fault for the worker to forget or neglect to replace the guards if, for any reason, they are temporarily removed. The device shown in the accompanying illustration (see page 196) is intended to provide for such neglect on belt-driven machines by stopping the



Safety Device C is Arranged to Knock Driving Belt A off its Pulleys if the Machine is Started before Metal Guard B is Bolted in Place

machine when the guard is not in place. Although exactly the same arrangement cannot be used in every case, this may serve to suggest other arrangements for similar applications.

In this instance, a sheet-metal guard *B* is provided for the belt *A*. It is not often that the belt requires attention, but a gear adjustment (not shown) entails frequent guard removal, and it was to enforce its replacement that the knock-off device *C* was designed.

The safety device comprises a U-shaped metal strap *D* which is held in position by two bolts *E* and two coil springs *F*. There are two holes punched in the guard for bolt clearance. When the guard is fastened to the machine face, it forces strap *D* clear of the belt. However, should the machine be started without the guard in place, the pressure of the springs on the strap would be sufficient to knock the belt off its pulleys immediately.

Air-Operated Milling Fixture for Machining Parallel Surfaces

By HAROLD E. MURPHEY, Westerly, R. I.

An air-operated milling fixture used for straddle-milling a textile-machine bobbin finger has solved the problem of machining parallel surfaces on the ends of the work. As shown in the accompanying illustration, the work has two surfaces *X* and *Y* which have previously been ground. Surfaces *S* must be milled parallel and in line with *X* and *Y*.

The fixture consists of a base *A* on which is mounted air cylinder *B*. An operating stud *C*, made of round hardened tool steel, which is milled to an angle on one side, slides in a slot in bearing *D* and contacts clamp-operating lever *E*. This bearing acts as a thrust member when lever *E* locks the clamp *G* onto the work. Bearing *D* is a separate casting, and is fastened to the base with 3/8–16 Allen cap-screws. Lever *E*, also made of hardened tool steel, pivots on a 1/2-inch pin *F*. The over-all size of the base of the fixture insures rigidity.

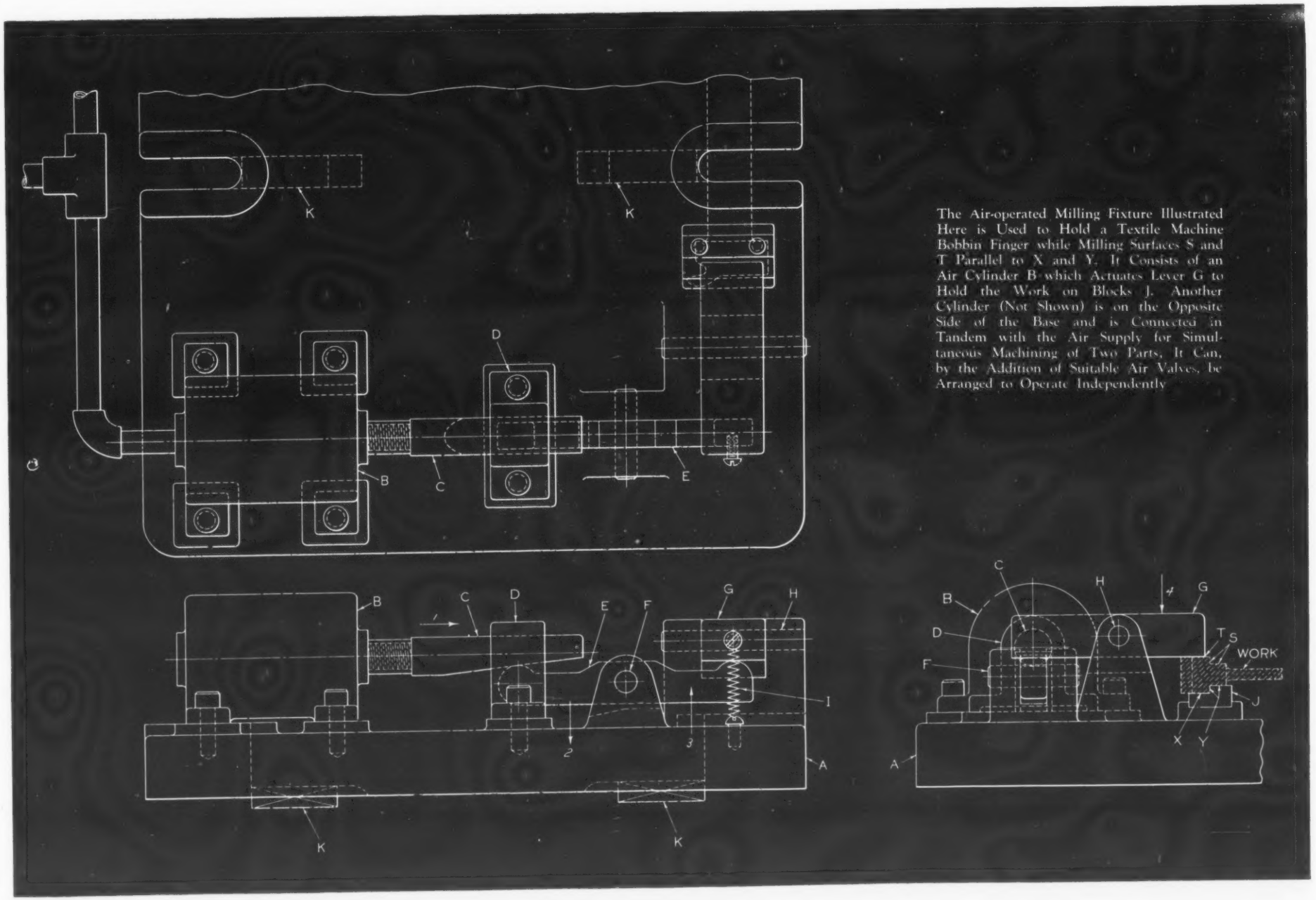
When the fixture is in operation, the work is laid on locating blocks *J*. As the air is turned on, the operating stud moves forward in the direction of arrow No. 1 and forces the left-hand end of lever *E* down in the direction of arrow No. 2. This movement raises the opposite end of the lever, as indicated by arrow No. 3. This end of the lever contacts work-clamping lever *G*, thus pushing it down onto the work and locking it in position.

After the work has been milled, the operating stud is retracted. When this occurs, the tension spring *I* pulls clamp *G* down, thus returning lever *E* to its original position. The work can then be removed from the fixture.

Although only half of the fixture, and hence but one air cylinder, is shown in the illustration, two cylinders actually are mounted on the base. They are arranged in tandem for simultaneous clamping of both ends of the work, but can, by the addition of valves in the air supply lines, be made to operate independently of each other.

* * *

The engineering department of Northrop Aircraft, Inc., Hawthorne, Calif., numbered about 650 persons at the peak period of World War II. Now there are approximately 1100 persons on the payroll of this department, and the company expects to employ a total of 1500 persons in order to perform the engineering work on current long-term contracts. In addition to producing aircraft, the company conducts research in the guided-missile and nuclear-energy fields.



The Air-operated Milling Fixture Illustrated Here is Used to Hold a Textile Machine Bobbin Finger while Milling Surfaces S and T Parallel to X and Y. It Consists of an Air Cylinder B which Actuates Lever G to Hold the Work on Blocks J. Another Cylinder (Not Shown) is on the Opposite Side of the Base and is Connected in Tandem with the Air Supply for Simultaneous Machining of Two Parts. It Can, by the Addition of Suitable Air Valves, be Arranged to Operate Independently

National Metal Congress and Exposition

THE thirtieth annual National Metal Congress and Exposition, sponsored by the American Society for Metals, will be held at the Commercial Museum and Convention Hall, Philadelphia, Pa., for five days, beginning on October 25 and continuing through October 29.

Under the theme "A Salute to Alloy Steel," the Metal Show will commemorate seventy-five years of progress in alloy steel development. A panorama of alloy steel production and fabrication will be presented on the stage of the Convention Hall. "Distinguished Service Awards" will be presented to individuals who have contributed to the improvement, development, and application of alloy steel.

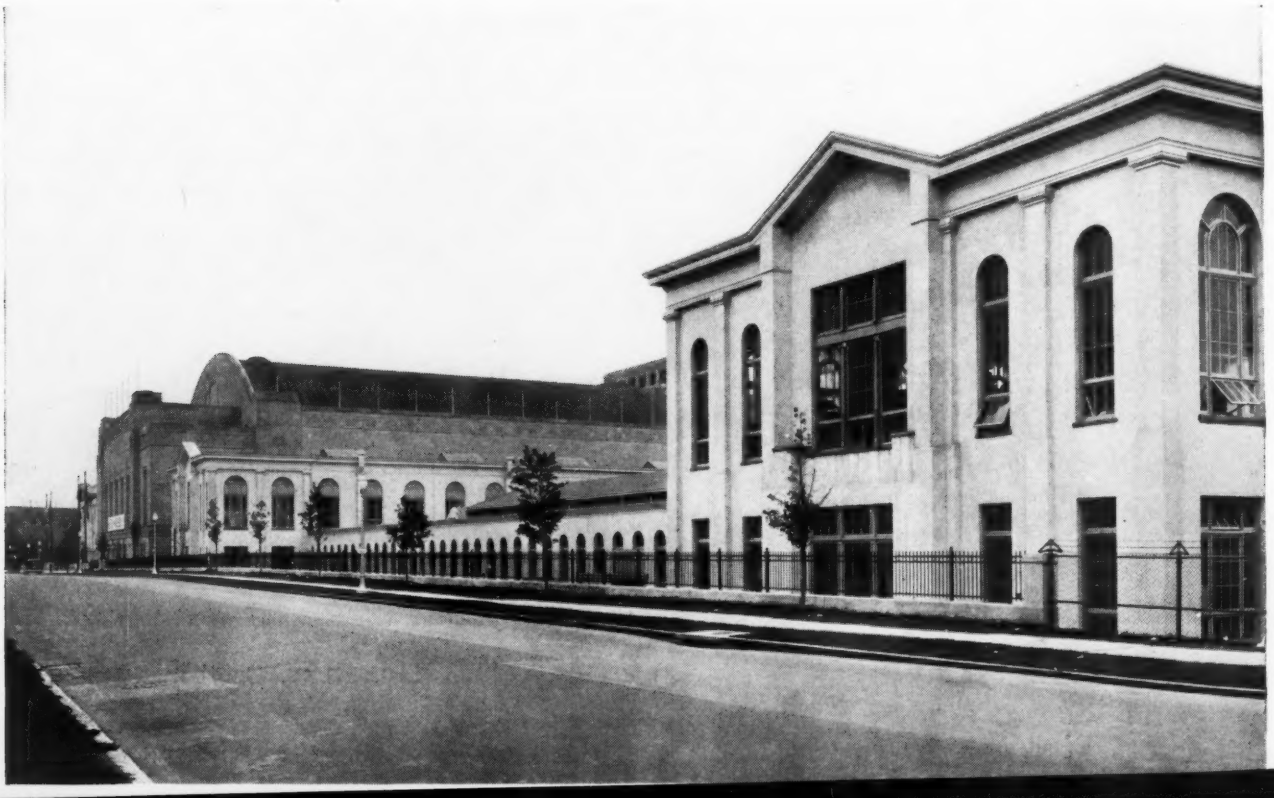
Over 350 manufacturers and processors of metals and metal products will have displays at the Exposition, and more than 100 technical papers on alloy steel will be presented at the Congress. As in past years, the National Metal Congress will combine technical sessions of the American Society for Metals, the American Welding Society, the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, and the Society for Non-Destructive Testing.

Heat-treatment and the mechanical and engineering properties of steel are the subjects of many technical papers, including: "The Dimensional Stability of Tool Steels"; and "Basic Reasons for Good Machinability of Free Machining Steels." Under the subject of testing will be papers on: "The Abrasion Resistance of Metals"; "Nature and Detection of Grinding Burn in Steel"; and "The Supersonic Reflectoscope — an Instrument for Non-Destructive Testing and Measuring by Means of Sound Waves."

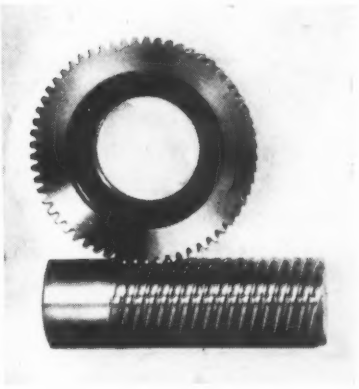
Among the many papers to be presented at the technical session of the American Welding Society are: "The Effect of Fabrication Processes on Steels Used in Pressure Vessels"; "Submerged-Melt and Inert-Gas Shielded Electric Welding Applied to Railroad Cars"; "Low-Temperature Silver Alloy Brazing of Copper-Beryllium Alloys"; "Metallizing as a Production Process"; "Powder Cutting and Scarfing in the Steel Industry"; "Weldability of Cast Carbon and Alloy Steels"; "Projection Welding"; and "Flame-Hardening Methods and Techniques."

A seminar on the cold-working of metals, arranged by M. Gensamer, Carnegie-Illinois Steel Corporation, for the American Society for Metals, will be held at the Benjamin Franklin Hotel on Saturday and Sunday, October 23 and 24. A symposium on rod and wire production practice, arranged by the Institute of Metals Division Program Committee, will be presented on Tuesday, October 26.

Headquarters of the American Society for Metals and the Society for Non-Destructive Testing will be at the Benjamin Franklin Hotel. The American Welding Society will hold its technical sessions at the Bellevue-Stratford, while the meetings of the Institute of Metals Division will be held at the Adelphia.



Thread-Generating Machine Adapted for Both Threading and Forming



Precision Lead-screw and Circular Cutter Used in Producing It on a Thread-generating Machine

CIRCULAR generating cutters like the one shown at *A*, Fig. 1, which rotate while being fed longitudinally along the rotating work-bar, as indicated by the arrows, are used in cutting precision threads on the new type Cornelis thread-generating machine illustrated in Fig. 2. This machine, now being introduced in this country by the George Scherr Co., 198 Lafayette St., New York 12, N. Y., can also be equipped with formed circular cutters like the one shown at *B*, Fig. 1, for producing formed parts, such as machine handles.

Machine tool lead-screws of high precision, feed-screws, worms, and special screws of any length and thread form, as well as formed parts, can be machined from bar stock on the new thread-generating machine by using interchangeable generating cutters of the correct forms.

The generating principle as applied in this machine was employed in 1896 by the inventor, Jean Cornelis, of Liege, Belgium, in a novel machine devised for cutting so-called hour-glass worms. For cutting this type of curved worm, which contacts the worm-gear over its full length, a circular cutter similar to the worm-wheel was used. In this early application, the cutter and work rotated together at the proper speed while the cutter was being fed to the required depth without longitudinal movement. This generating principle was next applied to the cutting of screw and worm threads of any desired length by developing a machine that provided a longitudinal as well as a rotating movement for the circular generating cutter.

Referring to Fig. 2, the cutter *C* of the thread-generating machine and the bar stock *W* on which the thread is to be cut revolve together at the correct predetermined ratio required to produce the desired thread. The work *W* is held in the universal self-centering chuck *D*. A special fixture can be used in place of the chuck for holding certain types of work. The work is supported directly below the cutter by bushing *E*, as shown in the rear view of the machine, Fig. 3.

The generating cutter *C*, having the same helix angle as the thread to be cut, is driven by a bronze worm-wheel *F*, which meshes with the ground-thread master worm or lead-screw *G*. The lead-screw has a 30-degree pressure angle

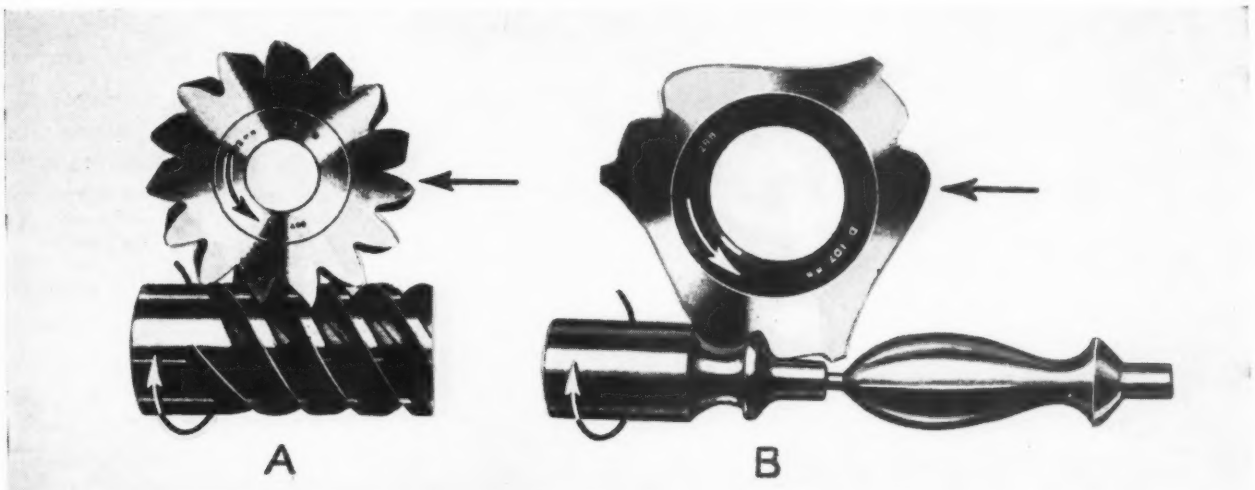


Fig. 1. (A) Circular Cutter and Worm Thread Cut on the Cornelis Thread-generating Machine Shown in Fig. 2. (B) Formed Circular Cutter also Used on Thread-generating Machine, and Formed Machine Handle Produced from Bar Stock by the Cutter

and is supported by a bearing directly below the worm-wheel. The arbor on which worm-wheel *F'* and cutter *C* are mounted is carried on a bearing block secured to the heavy gear segment *H*, mounted on a trunnion bearing concentric with the master worm *G*.

The depth of the thread-generating cut is controlled by the graduated handwheel *J*, acting through gears and pinion *K*, which meshes with the teeth of segment gear *H*. This arrangement enables the segment *H* to be pivoted about its trunnion bearing, so that the cutter *C* can be fed into the work to the correct depth.

It will be noted that this method of driving the cutter directly from the worm-wheel eliminates any errors that might otherwise be introduced by change-gears, backlash of couplings, keys, etc. Also, owing to the fact that both the work as well as the master screw are equally supported in bushings, any bending or sagging, due to their own weight, is avoided. Thus, the accuracy of the master lead-screw is directly reproduced on the lead-screw to be cut. The work is free to expand in a lateral direction.

The circular cutters are of high-speed steel and are sharpened on their faces only, any standard tool grinder being suitable for this purpose. After the machine has been set up with the proper gearing, the rotating cutter *C*, Figs. 2 and 3, is fed into the work *W* to the required depth, using the 0.001-inch graduations on the handwheel *J*, Fig. 3. When the machine is set for the proper depth of cut, the carriage feed is engaged and the cutter generates the thread as it advances along the work-bar.

The heavy saddle is accurately fitted to the bed ways, and is guided by two cylindrical bars *M*, Fig. 4. Two feed-screws *N*, operating simultaneously, provide a smooth, positive feed for the carriage. With this feeding arrangement, the teeth of the circular cutter come successively into full-depth contact with the work, so that each tooth removes a small chip. This cutting action results in long life for the cutter and excellent finish on the work.

The machine is fully automatic, and after being set up, is simple to operate. It is made in two types—a plain heavy-duty machine, with heavy saddle and outboard support for the cutter-spindle; and a universal type machine (shown in the illustrations), designed for general production of lead-screws and threads. Each type is made in four different bed lengths with capacities for cutting threads up to 18, 37, 77, and 116 inches. Longer screws can be cut, however, by resetting the work.

These machines can be used for threading work from 5/16 inch to 4 1/4 inches in diameter, and for forming work up to 2 1/2 inches in diameter. With attachments, worm-wheels up to 6 1/4 inches in diameter can also be cut. The maximum-pitch thread which can be cut on the plain machine is 1 inch, and on the universal machine, 3/4 inch. All machines will cut threads up to a maximum helix angle of 30 degrees. Each machine has nine speed changes, covering a range from 140 to 856 R.P.M. Fifteen feeds are available, ranging from 0.132 inch to 20 inches per minute. Both plain and universal machines can be driven by a 3-H.P. motor.

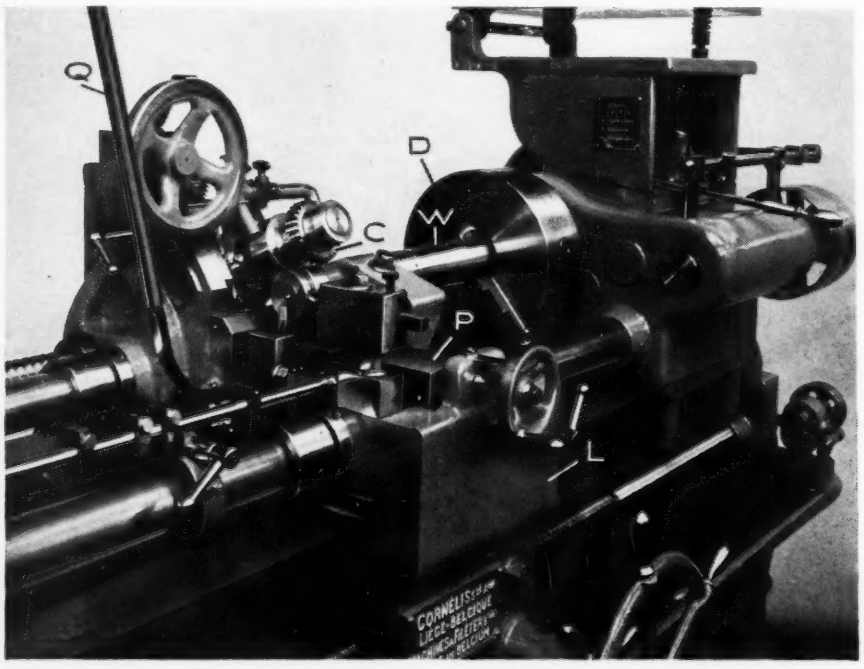


Fig. 2. Front View of the New Cornelis Thread-generating Machine Introduced on the Market by the George Scherr Co.

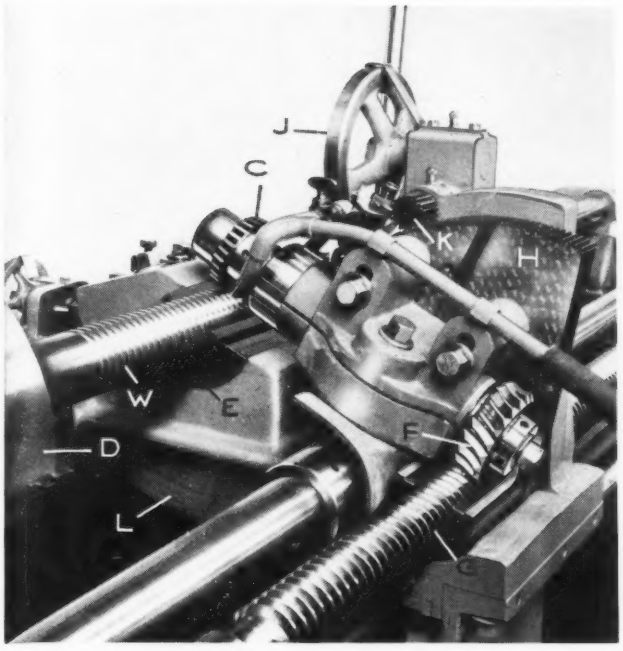


Fig. 3. Rear View of Thread-generating Machine Illustrated in Fig. 2, Showing Master Lead-screw G, Cutter C, and Thread W

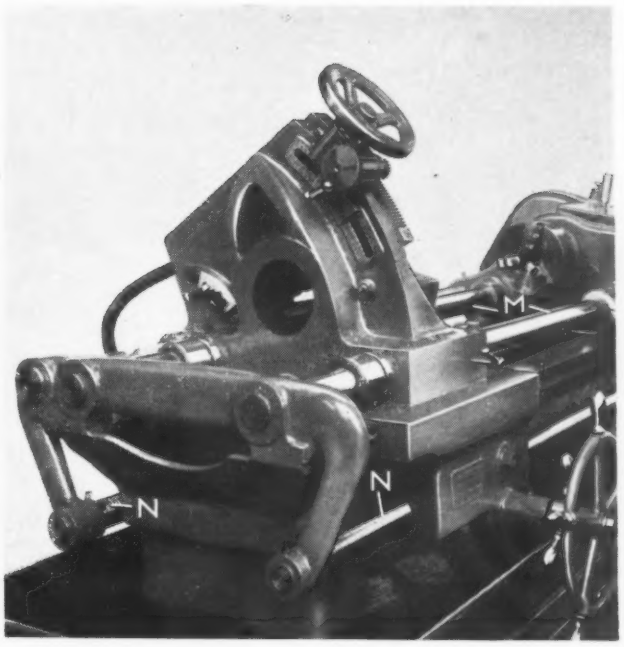


Fig. 4. View Showing Left End of Thread-generating Machine which Employs Circular Rotating Cutters in the Manner Illustrated in Fig. 1

A cross-slide carriage *P*, Fig. 2, can be provided on the universal machines for turning shoulders and other shapes on bar stock. A parting-off slide, operated by lever *Q*, is available for use when a series of short screws is to be cut from a long bar. An end-milling attachment is also available for cutting keyways along the bar to be threaded. Thus, precision lead-screws can be produced on this machine by first milling the keyway and then cutting the lead-screw thread on the thread-generating machine. This eliminates the burring operation on the teeth required when the conventional method of machining lead-screws is employed, since the thread-generating method leaves no burrs on the teeth or sides of the keyway.

Annual Meeting of American Machine Tool Distributors' Association in Detroit

THE American Machine Tool Distributors' Association held its twenty-fourth annual meeting at the Hotel Statler in Detroit on September 16 and 17. Speakers at the sessions included W. J. Scott, president, Van Norman Co., Springfield, Mass., who discussed the "Responsibilities of the Machine Tool Distributors to the Machine Tool Builders"; George Habicht, Jr., president, Marshall & Huschart Machinery Co., Chicago, Ill., who presented the distributors' side in a talk on "Responsibilities of the Machine Tool Builders to the Machine Tool Distributors"; Burnham Finney, editor, *American Machinist*, whose topic was "The Outlook of Capital Goods"; and A. G. Bryant, president, Bryant Machinery & Engineering Co., Chicago, Ill., and president of the National Machine Tool Builders' Association, who had just returned from Europe. Mr. Bryant's talk, "The Machine Tool Picture Today," was based on observations of the machine tool situation as he found it in Europe and his intimate knowledge of domestic machine tool conditions. The principal speaker at the dinner was Honorable Howard A. Coffin, U. S. Representative from Michigan, who spoke on "Process of Government as a Businessman Looks at It."

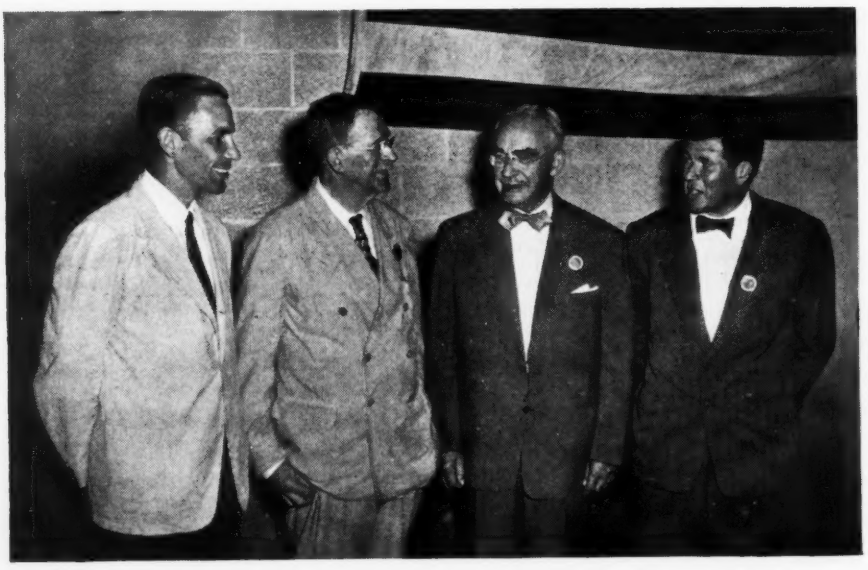
The following officers were elected for the coming year: President, R. L. Giebel, Giebel, Inc., New York City; first vice-president, O. W. Johaning, Colcord-Wright Machinery and Supply Co., St. Louis, Mo.; second vice-president, E. B. MacDonald, Syracuse Supply Co., Syracuse, N. Y.; secretary-treasurer, C. C. Brogan, W. E. Shipley Machinery Co., Philadelphia, Pa.

Norton Co. Dedicates New Grinding-Wheel Plant

A MANUFACTURING plant believed to be the largest in the world devoted to the manufacture of grinding wheels was dedicated on August 30 by the Norton Co., Worcester, Mass. The new building is 600 feet long by 300 feet wide, and contains approximately five acres of manufacturing space on one floor. Only directors, executives, and superintendents of the company and the personnel of the new plant attended the dedication ceremony. The total cost of this plant was estimated to be $4,300,000, of which $1,800,000 was expended for the building and $2,500,000 for equipment.

The building was designed for straight-line production, with parallel manufacturing lines that produce grinding wheels under a radically new process. More than 10,000,000 grinding wheels have been made by the new process—first in a pilot plant, and for the last few months in the new building. A feature of each production line is the continuous electric firing of grinding wheels in specially designed kilns. Modern conveying equipment has been installed to reduce handling to a minimum. The building contains the latest type of equipment in the way of fluorescent lighting, ventilation, dust collection, and fire protection, as well as modern locker and shower rooms, a cafeteria, a hospital, and offices. All facilities were planned to accommodate 800 persons employed on two shifts.

Eighty-two per cent of the wall area is devoted to windows in order to provide maximum daylight. The roof is of the monitor type to further increase the daylight and allow for adequate ventilation. The inside of the entire plant has been painted a restful shade of green.



(Above) One Corner of the New Norton Plant, Showing Production Lines where Finishing Operations are Performed on Mounted Points and Wheels for Internal Grinding

(Left) Sons and Grandsons of Original Founders in Dedicatory Exercises of New Norton Plant. (In Usual Order) John Jeppson, Assistant Secretary and Superintendent of the New Plant; the Late Aldus C. Higgins, Chairman of Executive Committee, Who Passed Away Shortly after This Event; George N. Jeppson, Chairman of the Board; and Milton P. Higgins, President

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER Sales Engineering Consultant

Friends Who Can Help the Sales Engineer

FRIENDSHIP with customer personnel is one of the sales engineer's greatest assets. It channels his progress in selling. But how about friendships with people outside the customer organization? Often the inexperienced sales engineer does not appreciate their value, and fails to cultivate them. Lots of times they can be of real help. They can be an important resource toward reaching the customer from every angle.

Think of the prospect as being in the center of a circle. From every point on the circumference, arrows can be directed that carry ideas favorable to the sales engineer, his product, and his company. One group of arrows is directed by the sales engineer himself. These are his own personal efforts in customer contact. Another group of arrows reaches the prospect through advertising in its various forms. Still a third group of arrows can be made to come from a variety of sources not directly related to the sales engineer or his organization. They may come from friends who are in a position to help the sales engineer. Thus one important part of resourceful selling is to become acquainted with outsiders who can help, and gain their friendship and active support.

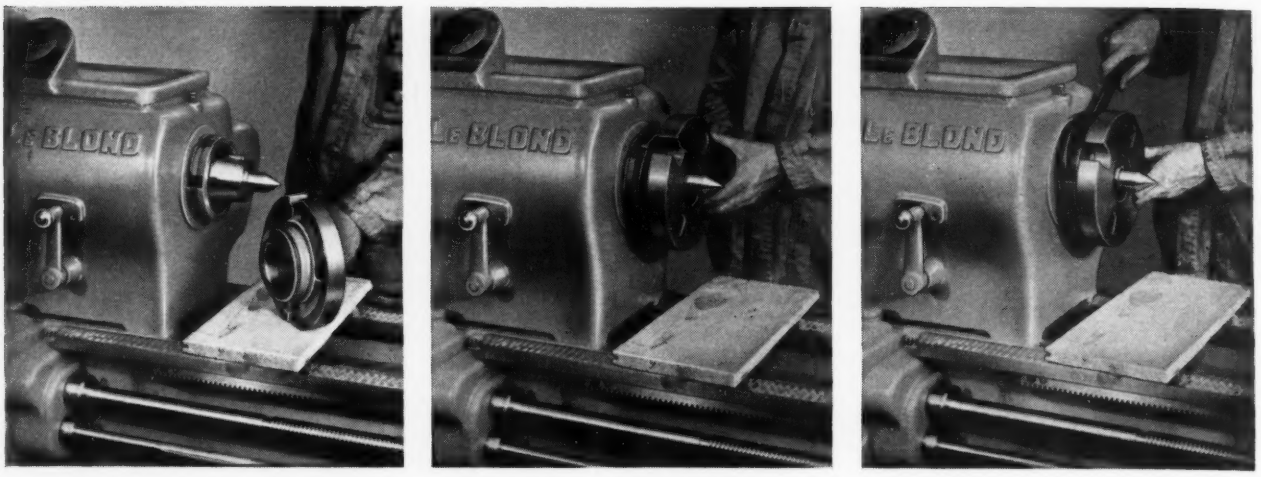
Let us consider some important sources of help: Most local banks take a keen interest in the industrial progress of a community. They have learned to reach out into business circles and seek new opportunities. Since rehabilitations and extensions of plants need capital, bank officials cultivate the officers of industrial companies and usually know in advance what is going on. Their friendships in industry are extensive and valuable. Their help in getting an introduction to certain key officials or a tip upon a considered change at an early stage is invaluable. The help of a banker may go as far as to obtain at least a careful consideration for the make of tools sold by the sales engineer.

Since the sales engineer sells an "investment" and not an "expense item," he and the banker have a common interest. Both want to see capital furnished for efficient production. Both are interested in rehabilitation, extension, and growth of manufacturing establishments. Even during the great depression of the thirties, important sales of machinery were made by skilled sales engineers in cooperation with local banking interests. The sales engineer saw the need for improvement. He proved that savings could be made through spending. Then he worked with the bank to the end that a favorable decision was made to finance an investment, even though times were bad and selling next to impossible.

In many instances, the sales engineer can get help from non-competing sales engineers who cover the same territory and the same customers. In one case, a pump and compressor salesman and an electrical machinery salesman covering an extended coal mining area became personal friends. Travel was difficult and trips rather infrequent. To a degree these two sales engineers served as scouts and checkers for one another. This type of friendship is valuable.

Most progressive manufacturers hire outside specialized talent for certain services, a fact that can present the sales engineer with opportunities. For example, a friendly advertising agency can help the sales engineer meet the right people in the client's manufacturing organization. I know of a case in which a sales engineer's prospect employed engineering consultants to revise production procedure. The sales engineer cultivated these consultants, and they proved of great help to him through support of his selling plans.

Contractors employed by the sales engineer's prospects must not be overlooked. Often, though their work relates only to plant facilities, they form close relationships with key men in the customer organization and their help is of value.



Steps Involved in Assembling a Chuck or Faceplate on the Standard Taper-key Drive Spindle Nose Consist of (1) Lifting the Faceplate on the Nose; (2) Positioning the Keyway on the Spindle-nose Key; and (3) Tightening the Coupling Collar

Many younger sales engineers, or those assigned to a new territory or group of customers, are at a loss to find a sympathetic point of customer contact. Not only can non-competitive suppliers help, as outlined, but sometimes large purchasers of customer products can also be of assistance. They, too, have had to solve the problem of "breaking in."

There are always two important factors to bear in mind in developing and using the friendship of people outside the customer organizations. First is that these friendships must possess a two-way channel of service. To get, the sales engineer must also give. Second, friendship depends upon confidence. Broadcasting of specific secret information furnished the sales engineer soon destroys a valuable friendship.

One great factor in selling is to be resourceful. Resourcefulness springs from an active imagination. Think of every possible avenue of help—every arrow of contact—not only to close a specific deal, but also to keep informed for the future and to build good will.

* * *

Francis Frary to Receive ASM Medal

Francis Cowles Frary, director of research of the Aluminum Co. of America, has been elected to receive the Gold Medal for 1948 of the American Society for Metals. The medal is awarded "for outstanding metallurgical knowledge and great versatility in the application of science to the metal industry, as well as exceptional ability in the diagnosis and solution of diversified metallurgical problems." It will be presented at the National Metal Congress and Exposition this month.

Spindle Nose with Standard Taper-Key Drive Applied to Regal Lathes

The standard taper-key drive spindle nose pioneered by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, in 1935 and since adopted by many other lathe builders, is now being furnished on LeBlond Regal lathes in place of the threaded type of spindle nose. As a result of this change, tapered chucks and faceplates can be interchanged between Regal lathes, LeBlond heavy-duty lathes, and several other types of lathes.

One of the advantages claimed for this spindle nose is easier mounting of chucks and faceplates. The operator merely has to line up the keyway with the key and then push the chuck on the spindle nose, as indicated in the illustrations. The loose fit of the thread in the coupling collar and on the chuck or faceplate permits quick attachment and insures accurate holding without binding.

Another advantage of this construction is the lock-tight mounting provided. Chucks and faceplates cannot fly off the spindle, even at high speed, and the danger of injury to an operator's hands is eliminated. Since the bearing surface is not subject to wear, accuracy of the assembly is retained indefinitely. Low accessory inventory is another feature claimed, due to the fact that special chucks and faceplates are not required.

* * *

Steel shipments in 1947 set a peacetime record, reaching 63,138,659 net tons; this figure was only 1.6 per cent below the wartime peak of 64,193,159 net tons.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Acme-Gridley Single-Spindle Automatic Designed for the Manufacture of Parts from Tubing

A single-spindle automatic designed especially for the mass production of parts from tubing by performing simple operations, such as turning, forming, straight or taper boring, and cutting off, has been brought out by the National Acme Co., 170 E. 131st St., Cleveland 8, Ohio. By limiting the machine to these simple operations, it was possible to combine simplicity of construction with the strength and stability required for the maintenance of high-precision tolerances at exceptionally high output rates through the application of high-speed or carbide-tipped tools. As shown in Figs. 2 and 3, the machine is of compact design, with the spindle center only 41 inches from the floor.

The heavy work-spindle is supported in a double anti-friction bearing at each end, and is direct-driven by means of sheaves using a V-belt drive from the motor. By changing the sheaves and motors, the following spindle speed ranges are obtainable: 1800 to 900 R.P.M.; 1200 to 600 R.P.M.; and 1450 to 725 R.P.M. When a greater variety of speeds is needed for short-run jobs, spindle change-gears can be provided.

The forming slide of this new automatic is of the regular Acme-Gridley angular type, as shown in Fig. 1. The end-working slide is a combination type which enables straight or taper boring and outside radii turning to be performed simultaneously. The turning slide is equipped with a relieving cam which eliminates tool drag on the work as the slide recedes. The cut-off slide, mounted on the face of the frame, is lever-operated directly from the main camshaft.

The stock stop is connected to the cut-off slide so that, when the latter recedes, the stop automatically slides into the stock gaging position. This simple arrangement of slides provides for a flexibility of tooling that facilitates handling different classes of work. The machine can be easily set up, has ample chip clearance, and is so arranged that one operator can easily run two machines.

The feed mechanism that controls the camshafts, drums, and cams which operate the slide and stock feed stop is gear-driven from the main spindle. The high and low camshaft speeds are usually controlled by an independent motor, but for work on which the same set-up is run continuously, this motor is eliminated, and the high, low, and reverse feeding mechanism is oper-

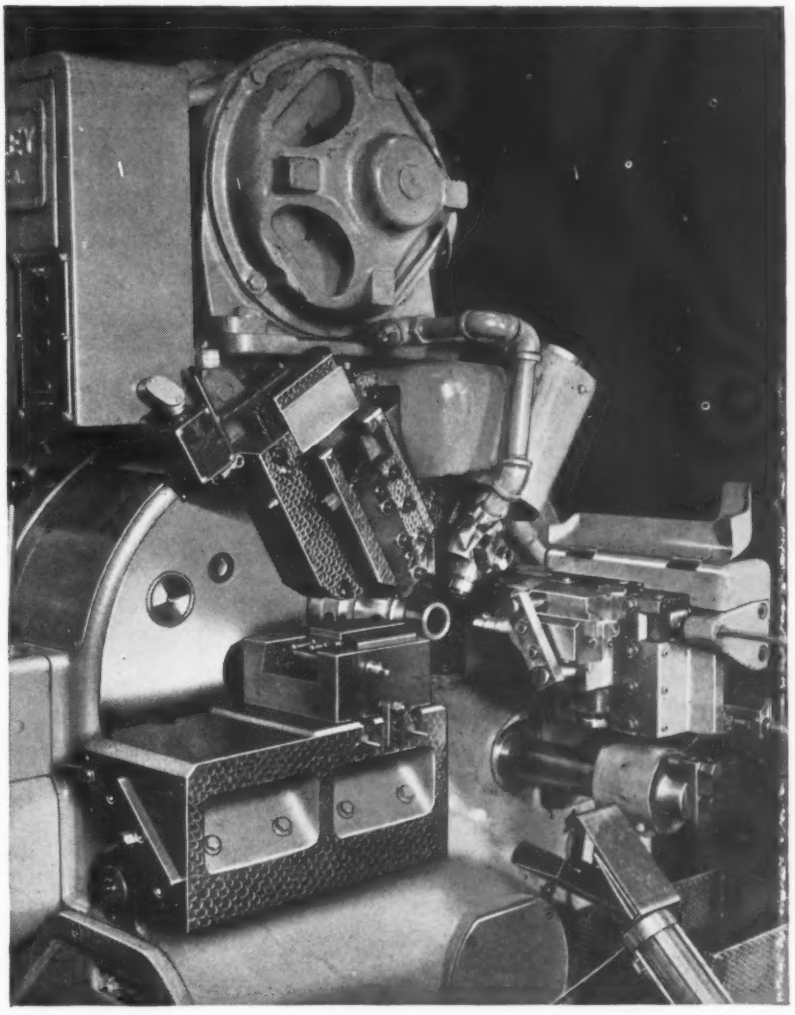


Fig. 1. Close-up View of Tool-slides and Chuck of the New Acme-Gridley Single-spindle Automatic Developed for Manufacturing Parts from Tubing

To obtain additional information on equipment described on this page, see lower part of page 238.

ated through a chain drive directly from the small worm-shaft.

Feed control is through a disk clutch and lever. As a safety feature when setting up, or in the event of a tool jam, a push-button allows the operator to throw the feed-lever to engage a reversing clutch, which returns the slides to their retracted positions, thus quickly freeing the tools.

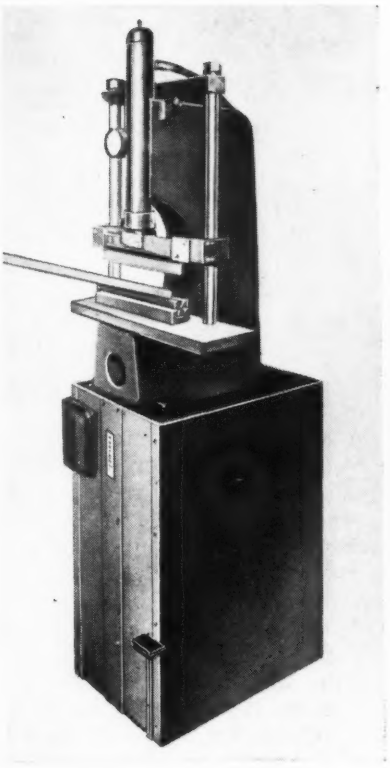
This SST model machine has no stock feed-tube, the stock being fed by cable, spring, and pusher-bar arrangement, as shown in Fig. 3. The pusher-bar is always under tension, so that the stock is fed forward the instant the collet opens. The 2- and 3-inch capacity machines are equipped with the company's standard stock-feed mechanism for tubing lengths up to 16 feet. Extra equipment can be furnished, if required, to handle longer stock. Machines above the 3-inch tube capacity size and up to the 12-inch size will be equipped with open type electric feeding mechanisms as regular equipment.

The 2- and 3-inch standard models have a turning and boring capacity of 1 1/2 inches; maximum travel of the boring and turning slide of 4 inches; maximum travel of the forming slide of 1 1/2 inches; maximum travel of the cut-off slide of 1 7/8 inches; and maximum feed-out with the standard stock stop of 1 1/4 inches. The 2-inch size is equipped with a 15-H.P. motor, and the 3-inch size with a 20-H.P. motor. The shipping weight of these machines is approximately 10,200 pounds. 61

Munton Hydraulic Press Brake

The Munton Mfg. Co., 9400 W. Belmont Ave., Franklin Park, Ill., has introduced a hydraulic press brake designed to handle a large variety of work. This press will readily make 90-degree bends in mild steel. It is made in three sizes—a 10-ton model handling 18-gage stock 3 feet long, 14-gage stock 2 feet long, and 10-gage stock 1 foot long; a 20-ton unit handling 12-gage stock 3 feet long; and a 30-ton size handling 10-gage stock 3 feet long.

The 10-ton hydraulic press brake with spring return, shown in the illustration, is used for forming only. A dual cylinder model, providing pressure on both the downward and upward strokes, is recommended for punching, broaching, pressing, and similar operations. The new machine has a throat depth of 9 inches between guide rods, which are 20 inches apart, and a 3-inch throat depth from the guide rods outward. It can be readily converted to a hydraulic press by removing cross-rods, tie-rods, and bed. 62



Munton Hydraulic Press Brake with Spring Return Mechanism

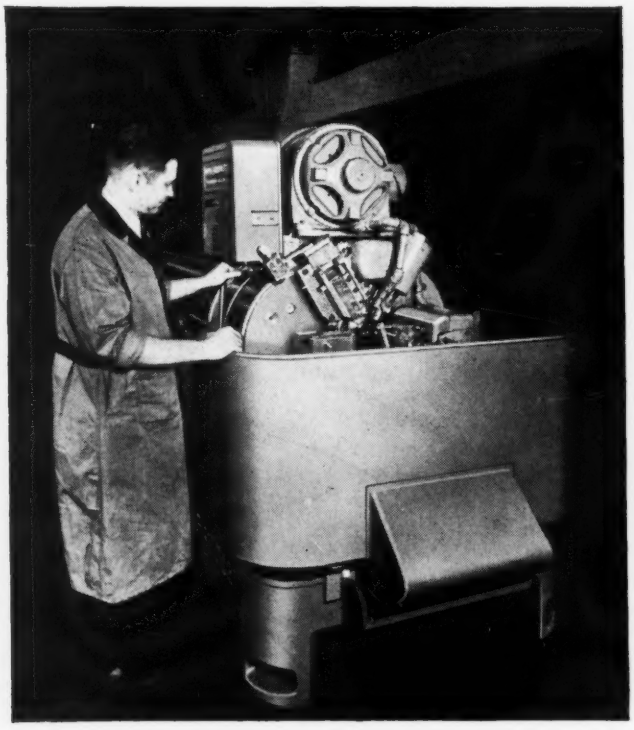


Fig. 2. Acme-Gridley Single-spindle Tube-machining Automatic

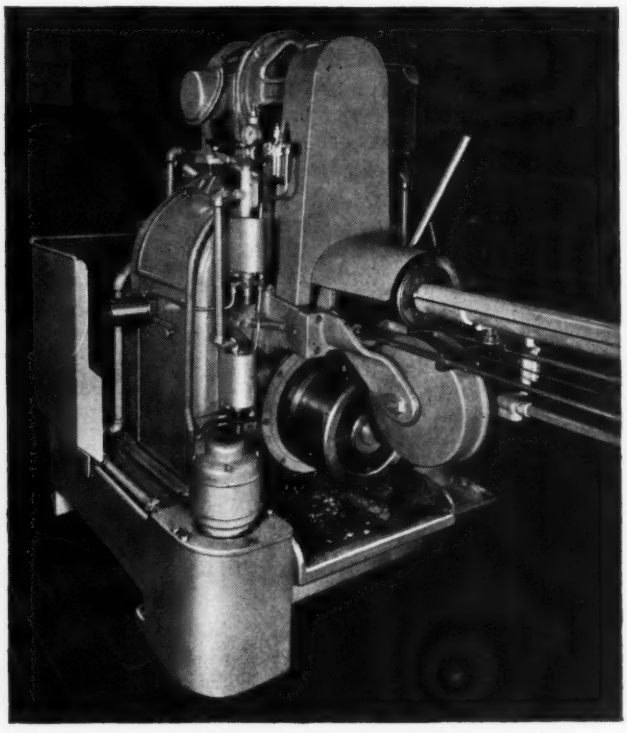
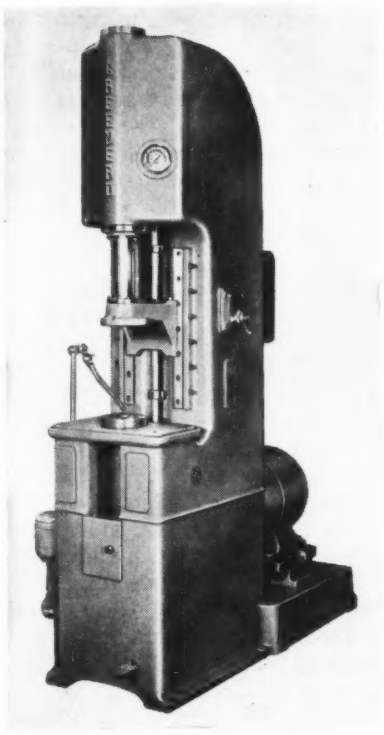


Fig. 3. Rear View of Acme-Gridley Automatic, Showing Stock-feeding Arrangement

To obtain additional information on equipment described on this page, see lower part of page 238.



Greenerd Hydraulic Broaching and Assembling Press

Hydraulic Broaching Press

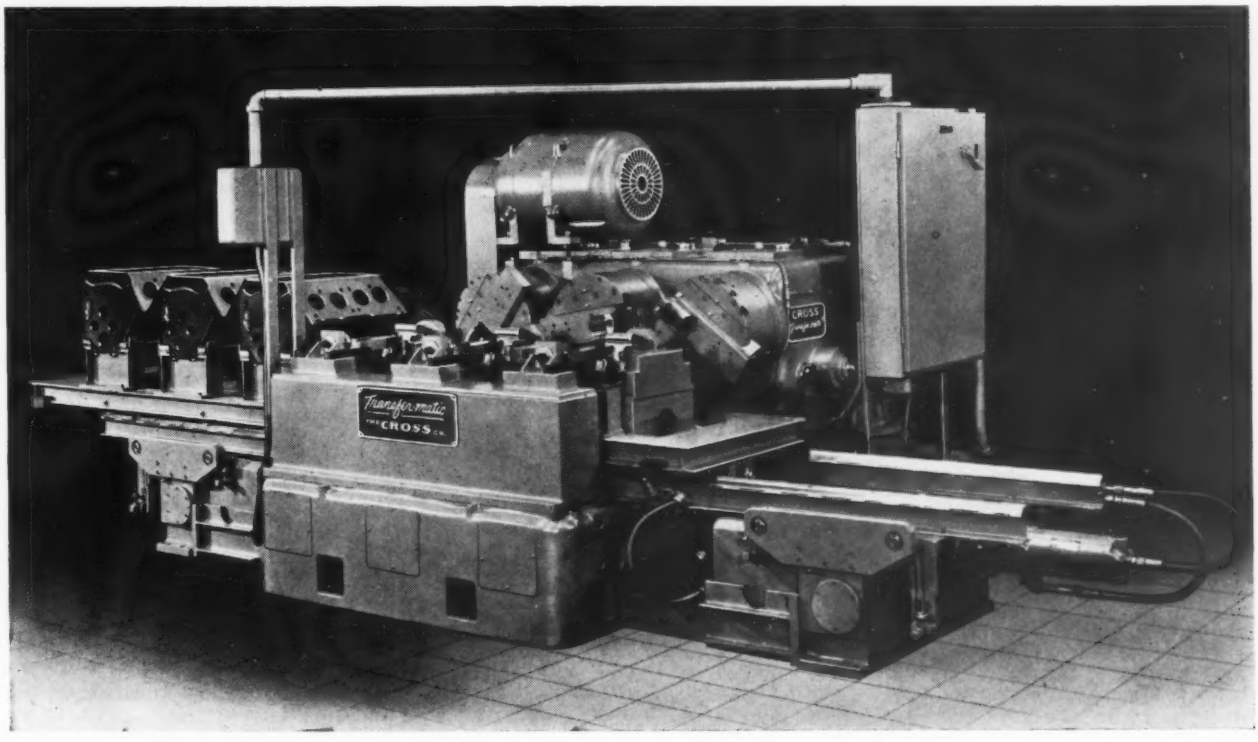
A self-contained hydraulic press of rugged construction, designed to handle broaching, assembling, and die work with a minimum of deflection, is a recent product of the Greenerd Arbor Press Co., Nashua, N. H. The downward speed of the ram of this press is adjustable from 20 to 300 inches per minute, and the return speed is 460 inches per minute. The equipment provides for wet or dry broaching and for assembly or die work. Dual ram control can be furnished to insure safe operation.

The press has a maximum capacity of 6 tons, and has provision for adjusting the pressure from 3/4 ton to 6 tons. It is driven by a 10-H.P. motor, interconnected by three V-belts with the hydraulic pump. Work 12 inches in diameter can be accommodated. Maximum daylight capacity is 21 inches, and minimum daylight space 3 inches. Ram travel can be adjusted from 1 to 18 inches, and is controlled by power stops. The work-table is 17 inches wide, 10 inches deep, and has a 3 1/2-inch cored hole in line with the ram. This machine is also available in 4- and 8-ton models. 63

Cross "Transfer-matic" Special Machine for Facing Cylinder Blocks

The Cross Company, Detroit 7, Mich., has announced the development of a special machine that finishes the transmission joint face of cylinder-block assemblies square with the crankshaft bore at a production rate of fifty-six pieces per hour. Parts are handled in multiple by a transfer mechanism, three blocks being faced at the same time. Only one operator is required, and no lifting of parts is necessary, since the blocks slide in and out of the machine on a conveyor with the help of the automatic power transmission mechanism. Locating and clamping of the work are also accomplished automatically on this new machine.

Single-point carbide facing tools are employed to insure accuracy, reduce heat at the cutting point, and eliminate unnecessary strains. Hydraulic valves are gasket-mounted and conveniently located for easy maintenance. This "Transfer-matic" can be expanded to include other operations. For example, units can be added for precision-boring the locating holes for the transmission or for finish-facing the crankshaft thrust faces, the transfer mechanism being lengthened by using standard units. 64



"Transfer-matic" Cylinder-block Facing Machine Built by The Cross Company

To obtain additional information on equipment described on this page, see lower part of page 238.

Betts Hydraulic-Feed Car-Wheel Borer

The Consolidated Machine Tool Corporation, Rochester 10, N. Y., has announced a new high-speed Betts hydraulic-feed car-wheel boring and hub-facing machine. The push-buttons and control levers of this machine are conveniently grouped to simplify operation. New features include an automatic table brake, operated in conjunction with the automatic feed and traverse cycle; Timken table spindle bearings; and antifriction bearings throughout the drive. The table stops automatically before the spindle starts its upward traverse, and thus prevents scoring the work. The square boring ram is provided with adjustable gibs on each side to maintain accuracy.

High speeds are available for the use of carbide tools, and a suitable speed range is provided for high-speed steel tools. Automatic speed reduction, obtained electrically between roughing and finishing speeds when desired, makes it possible to use a combination of carbide and high-speed steel tools. The machine table is completely sealed to permit the use of coolant.

This machine has a capacity for handling 17- to 48-inch cast-iron or steel wheels, using a five-jaw automatic self-centering chuck. Either one or two electric or pneumatic hoists, as required, can be furnished for use with this car-wheel borer. 65

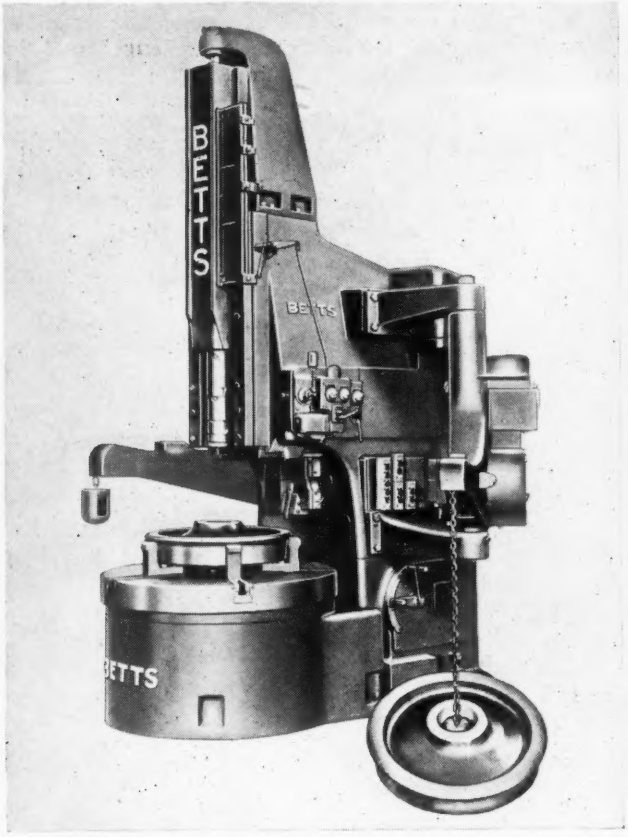
Semi-Automatic Plastics Molding Press

A large compression semi-automatic plastics molding press was recently built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, for a prominent molding company in Chicago. This machine has a pressure capacity of 500 tons; the maximum mold size is 42 by 36 inches; the daylight space between platen and head is 54 inches; and the maximum ram travel speed is 26 inches. The small internal booster ram provides high-speed closing of the dies at the rate of approximately 320 inches per minute. Automatic slowdown is provided prior to mold contact. The slow closing speed is adjustable. The press opens rapidly at speeds up to 108 inches per minute.

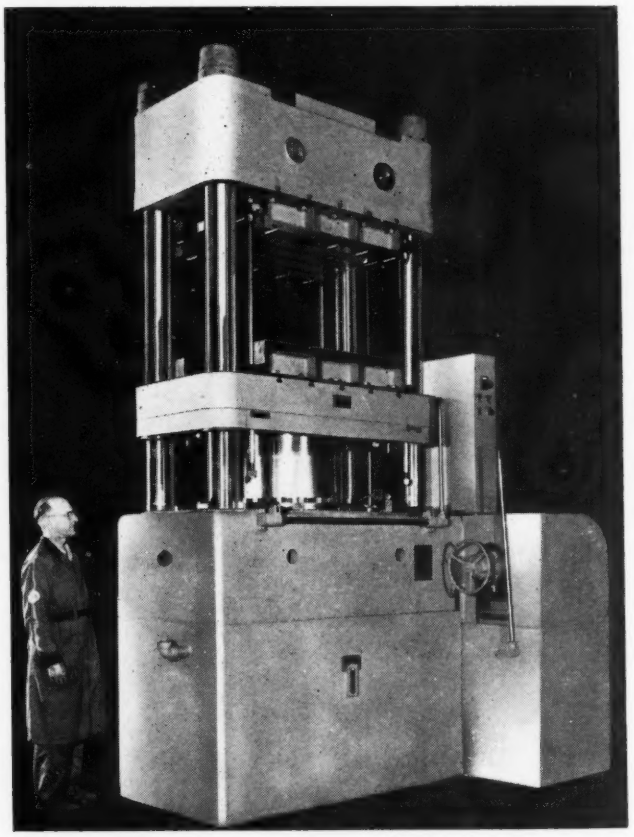
The new press is equipped with an automatic breathing or degassing cycle which can be used at the option of the operator. It has an H-P-M Hydro-Power variable-delivery, radial, piston-type hydraulic pump with direct electric motor drive. The press is provided with upper and lower mechanical ejectors. The lower ejectors are set manually. The grids, 8 inches thick, are attached to both the head and platen. This press is suitable for molding large thermosetting plastic parts, such as radio cabinets and instrument housings. 66

Zagar Standardized Keyway Broaches

Zagar Tool, Inc., 23880 Lakeland Blvd., Cleveland 23, Ohio, has developed a set of standard tools

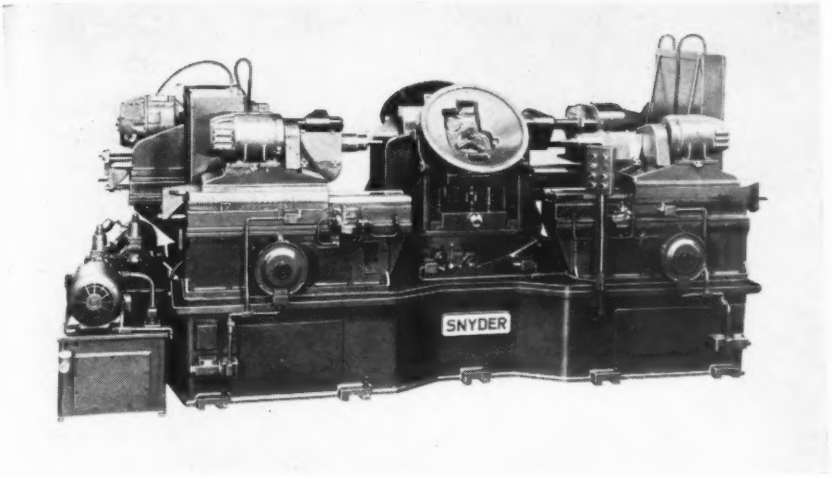


Betts Hydraulic-feed Car-wheel Boring Machine
Brought out by Consolidated Machine Tool Corp.



Large Semi-automatic Plastics Molding Press
Built by the Hydraulic Press Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 238.



Snyder Special Machine for Drilling and Boring Clutch Housings

for broaching keyways. These tools have been designed especially for use on short-stroke broaching machines in plants where many different sizes of holes and keyways must be cut in production quantities. With these standardized broaches, it is possible to cut keyways 1/2 inch wide by 1/4 inch deep by 4 inches long on a 20-inch stroke broaching machine, and keyways up to 1 inch wide by 1/2 inch deep by 6 inches long on a 36-inch stroke broaching machine.

This new set of broaches has standardized keyway broaching horns with interchangeable parts. By combining three separate parts, it is possible to reduce tool inventories. Charts are provided for quick reference which show the dimensions and sizes of all the new broaches and adapters. 67

Snyder Machine for Drilling and Boring Cross-Shaft Holes in Clutch Housings

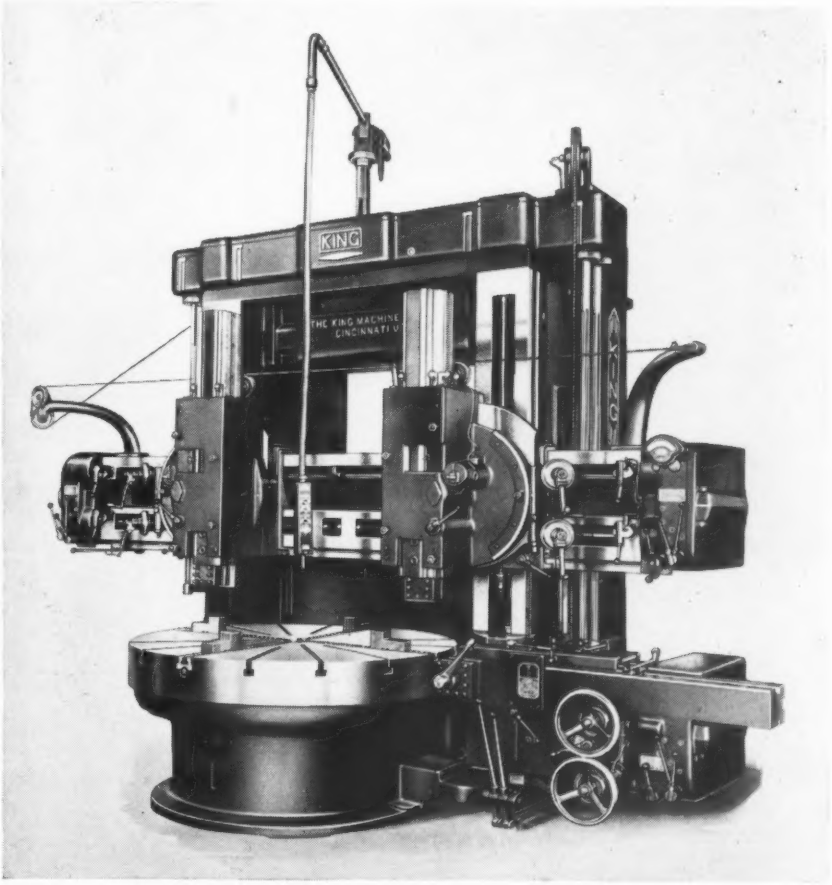
A machine that drills and line-bores cross-shaft holes in seventy different sizes and types of clutch housings has been built by the Snyder Tool & Engineering Co., E. Lafayette, Detroit 7, Mich. The work is manually clamped in two stations on a manually rotated Snyder index-table mounted centrally between the slide units. The two stations permit drilling and boring simultaneously.

Four hydraulically actuated Snyder standard slide units are mounted horizontally, and opposed, in pairs—front and rear. The two rear slides are equipped with single-spindle drill heads for drilling the cross-shaft holes, while the two front slides are equipped with Parker micrometer-adjusted boring spindles for finish line-boring the holes. The speed of the drilling and boring spindles can be changed to suit the size of the tools being used. Estimated production is sixty-five pieces an hour at 80 per cent operating efficiency. The machine requires a floor space of 175 by 75 inches. 68

King Vertical Boring and Turning Machines

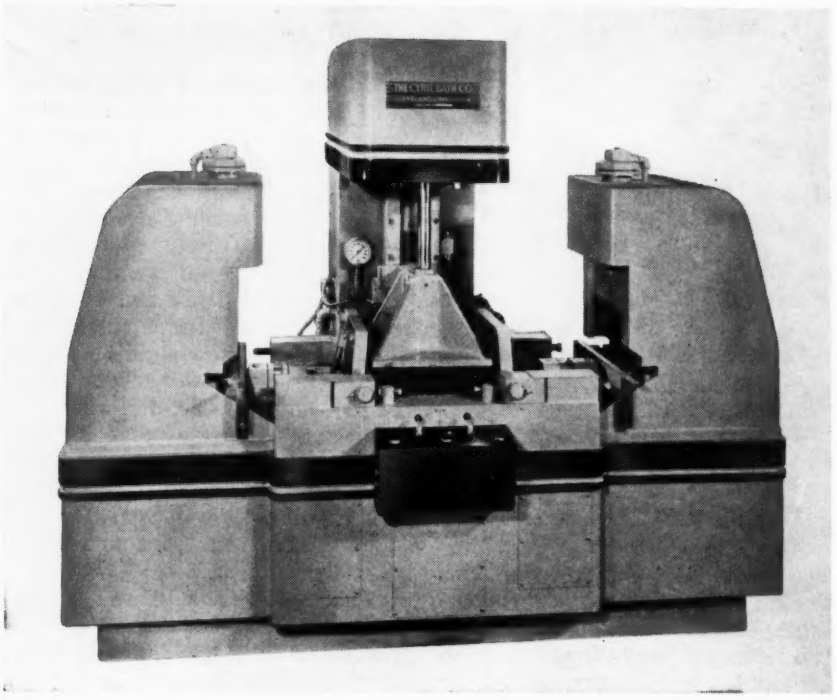
A new series of King boring and turning machines is being manufactured by the King Machine Tool Division of American Steel Foundries, Cincinnati 29, Ohio. Improvements developed to insure greater accuracy and versatility, easier operation, and longer service life have been incorporated in these machines. Heavier and more rigid construction, increased power, wider range of feeds and speeds, and other developments serve to make the machines particularly adapted for the use of carbide tools. The new rectangular type heads, for example, have four gibs and eight bearing surfaces.

The illustration shows a 72-inch model machine with two ram heads and a side-head. Similar machines are available in a wide variety of head combinations and in ten sizes. Single-column machines are made in 30-, 36- and 42-inch sizes, and double-column machines in 52-, 62-, 72-, 84-, 100-, 120- and 144-inch sizes. 69



King 72-inch Vertical Boring and Turning Machine

To obtain additional information on equipment described on this page, see lower part of page 238.



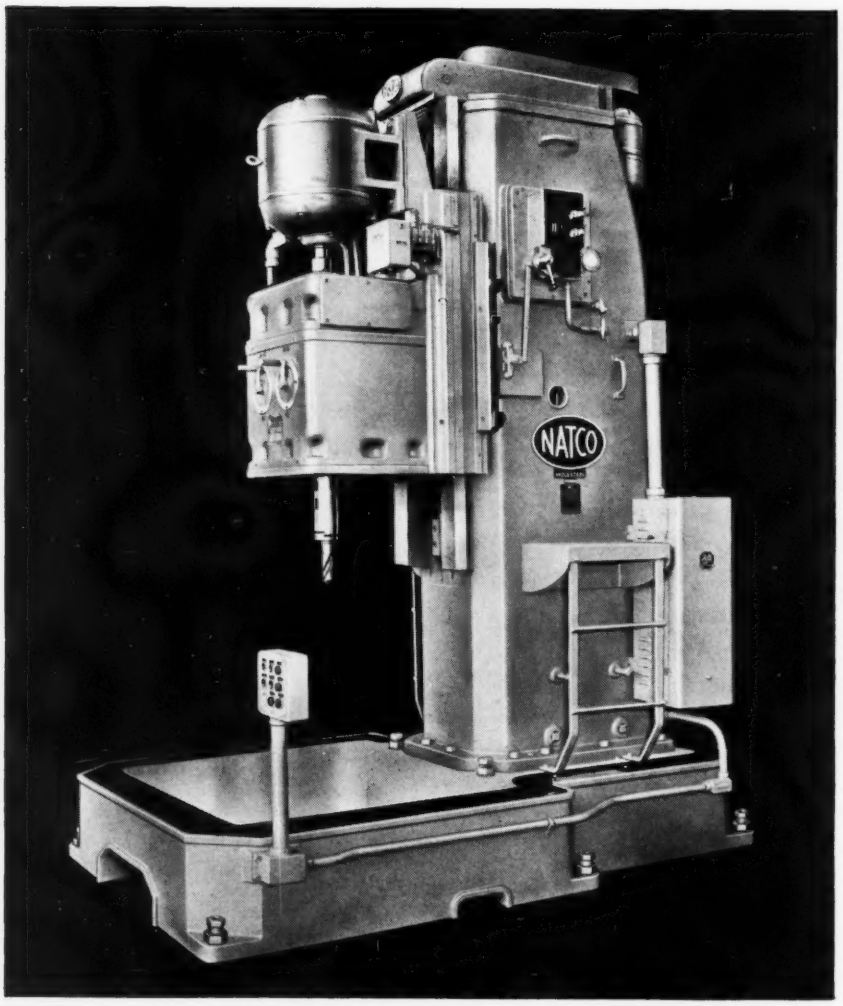
Automatic Cabinet-forming Machine Brought out by Cyril Bath Co.

Cyril Bath Cabinet-Forming Machine

A new automatic cabinet-forming machine is being manufactured by the Cyril Bath Co., 6955 Machinery Ave., Cleveland, Ohio. In this machine, three separate forming units are employed to make the bends required to completely shape the sides and back of the tub for a dishwashing machine from 18- to 20-gage cold-rolled enameled steel. The two outside heads of the machine contain forming slides that simultaneously form the curl and the reverse lip on the extreme ends of the part. These slides are hydraulically actuated and retract automatically. The sequence control then causes the center forming punch to descend and make the two large-radii bends with the assistance of the rocker plates.

The machine can be operated either automatically or manually. The outstanding advantage of this machine is that it permits three operations to be performed simultaneously. Production is approximately forty cabinets per hour. A similar machine forms the entire bottom section of the dishwasher. 70

Drill Testing Machine Developed by National Automatic Tool Co.



Natco Hydraulic Drilling Machine Developed for Testing Drill Life

The National Automatic Tool Co., Inc., Department 40, Richmond, Ind., recently developed a heavy-duty hydraulic drilling machine which is to be used by a prominent drill manufacturer for testing the durability of his product. This machine is designed to operate at peak efficiency under abnormal or overload conditions. It is equipped with a heavy-duty single-spindle seven-speed geared head to meet unusual stress and load conditions at various speeds.

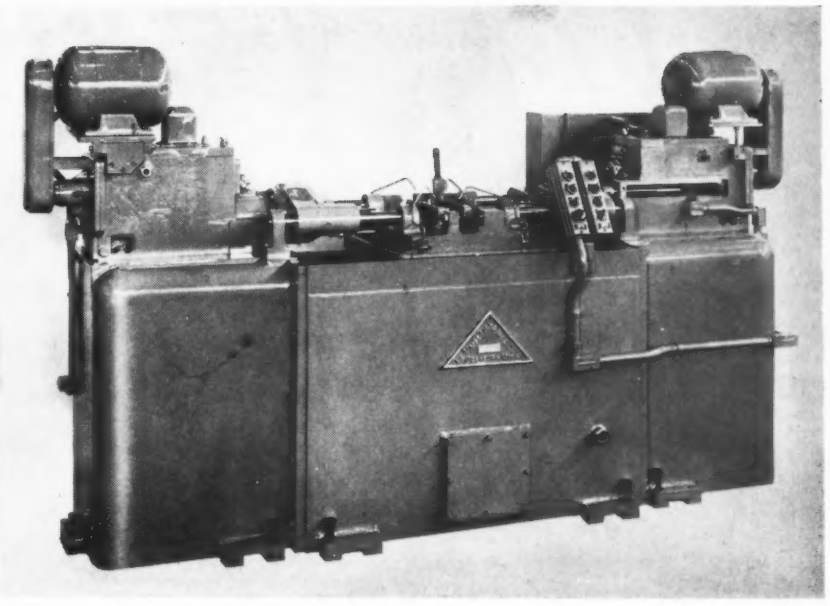
The 30-H.P. motor maintains a synchronous speed up to the rated horsepower when the drill becomes dull. As the load builds up to a predetermined value, a torque limiting device operates to stop the motor. A shear-pin arrangement is also provided to prevent destruction of gears in the head in the event of serious overloading. Change-gears give forty-two different speeds. 71

To obtain additional information on equipment described on this page, see lower part of page 238.

LeMaire Machine for Drilling Idler Arms

A two-way, four-spindle horizontal drilling machine designed for drilling cross-holes in steering idler arms has been built recently by the LeMaire Tool & Mfg. Co., 2657 S. Telegraph Road, Dearborn, Mich. This machine consists of a rigidly fabricated steel central base with two end bases, on each of which is mounted an improved LeMaire hydraulic-feed drilling unit equipped with a two-spindle head.

The work fixture is arranged to hold two parts for drilling 0.182-inch holes in opposite sides of a yoke at each cycle of the machine. A generous supply of coolant is provided from a coolant tank, built into the base of the machine. Production is approximately 300 pieces per hour. 72



Special Machine for Drilling Steering Idler Arms, Developed by the LeMaire Tool & Mfg. Co.

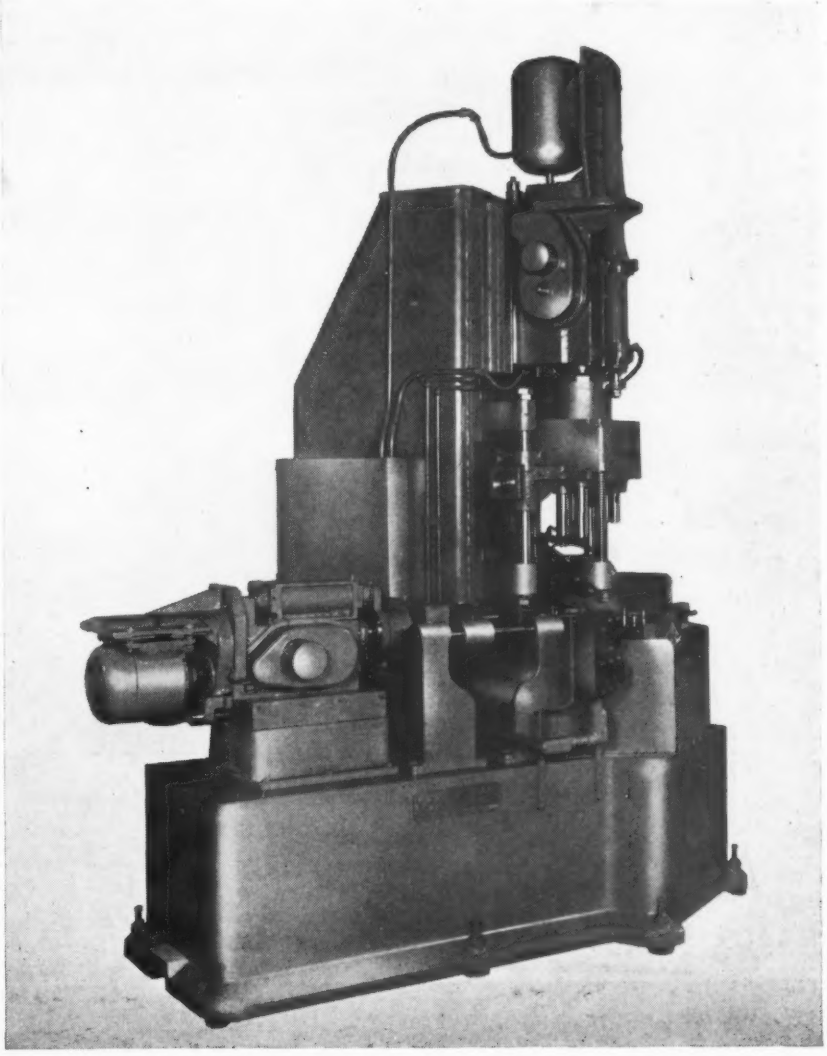
Millholland Automatic Indexing Machine

An automatic indexing machine has recently been built by the W. K. Millholland Machinery Co., 1048 Fairfield Ave., Indianapolis 5, Ind., for one of the large automotive manufacturers. This machine incorporates a recently redesigned No. 5 Millholland automatic unit of 10-H.P. capacity and 6-inch stroke, which is applied in a vertical position as shown in the illustration. The horizontal side-head comprises a No. 4 unit with 5-H.P. drive and 5-inch stroke. Other units can be added around the indexing table for performing additional operations as required.

The automatic indexing table has an independent motor drive, and is synchronized with the movement of the units by means of limit switches. The table can be had in various sizes up to 42 inches, with provision for making up to 600 or more indexing movements per hour. The machine is arranged for continuous or intermittent operation by push-button control, the operator only being required to load and unload the fixtures. Two or more pieces can be loaded in one station.

This machine is adapted for drilling, reaming, tapping, counterboring, chamfering, and spot-facing operations. The particular machine illustrated is equipped

Millholland Automatic Indexing Machine for Drilling, Reaming, Tapping, Counterboring, Chamfering, and Spot-facing Operations



To obtain additional information on equipment described on this page, see lower part of page 238.

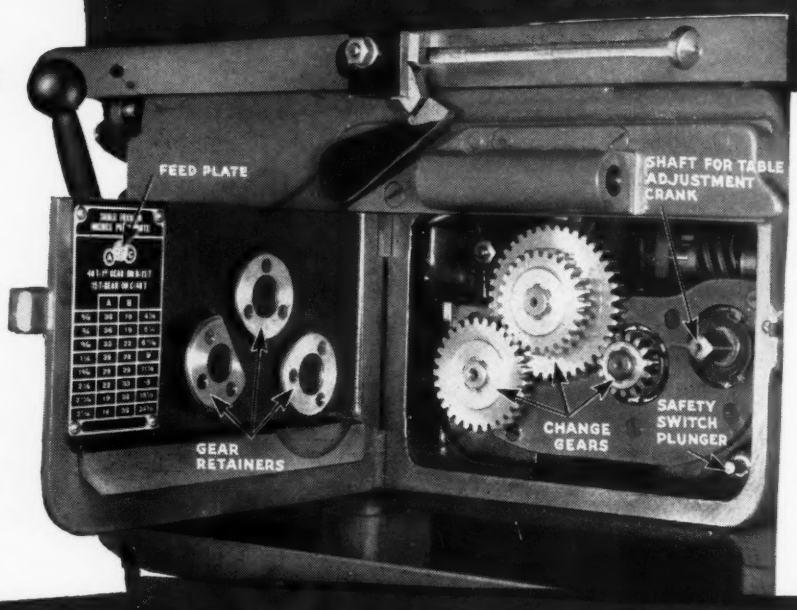
COUNT ON THESE No. 000 FEATURES

1 SIMPLE TABLE MECHANISMS FOR QUICK, ACCURATE SET-UPS

Pick-off Gears make the selection of proper feed rates easy and fast. Provide a choice of 16 rates of cutting feed, 9/16" to 24 3/8" per minute.

Hand Adjustment of table easily made by hand-crank with fast travel or cutting feed engaged. Point of table reversal is visually indicated at end of table cam — simplifying table adjustment.

Single Table Dog is quickly adjusted in its T-slot — engages cutting feed within accuracy of 1/16" — reducing non-cutting time to a minimum. Table reverses within .002" at end of any desired cutting feed length from 3/8" to 5 1/2".



2 FAST AUTOMATIC MILLING CYCLE

Reduces non-cutting time to a minimum. Operator merely loads work . . . pulls starting lever . . . unloads finished piece.

Start (manual) → Advance in Fast Travel–365" per Minute (maximum, 1–1/4 seconds) → Cutting Feed–Engaged by Dog (16 rates–9/16 to 24-3/8" per Min.) → Automatic Reverse

Stop (automatic) ← Return in Fast Travel–365" per Minute (return stroke takes less than 1–1/2 seconds)

3 RAPID SELECTION OF SPEED AND POSITIONING OF CUTTER

Easy-to-change, V-belt drive and 4-step cone pulleys provide 16 spindle speeds in either of two ranges — 105 to 2340 R.P.M. or 161 to 3540 R.P.M. Upper half of range is V-belt driven (no gear contacts). Lower half is driven by V-belt and back gears.

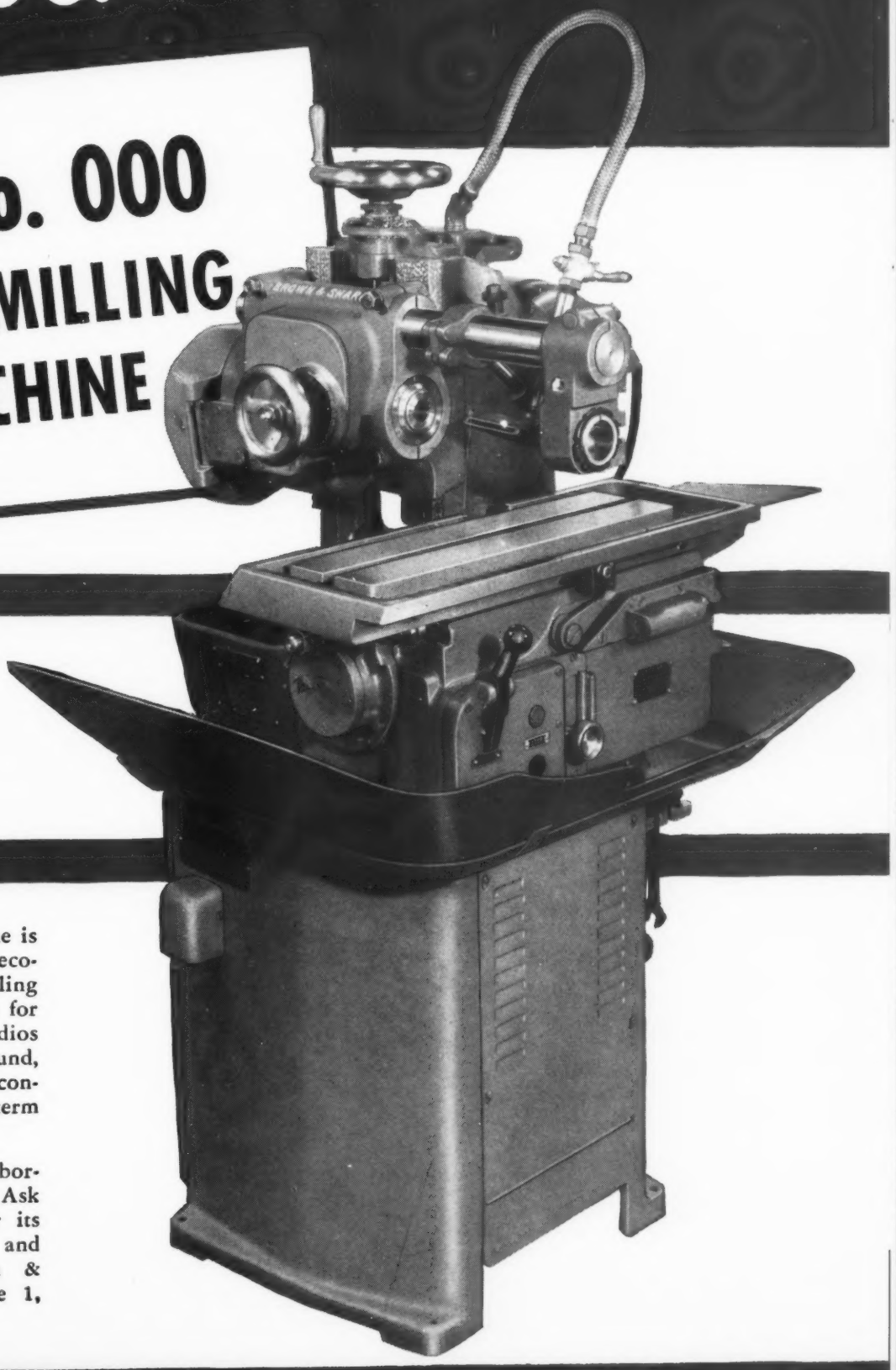
Wide range permits milling a variety of materials, using cutters down to the smallest end mills.

Conveniently located transverse and vertical adjustments provided at front of machine.

BROWN &

FOR PROFITABLE PRODUCTION OF SMALL PARTS

The No. 000 PLAIN MILLING MACHINE



Single lever operating control and automatic milling cycle make this machine simple and easy to operate.

This Brown & Sharpe Machine is designed specifically for the economical, rapid production milling of small pieces, such as parts for sewing machines, firearms, radios and business machines. Its sound, modern design and accurate construction assure the long-term safety of your investment.

Investigate its time-saving, labor-saving production possibilities. Ask for specifications. Look over its carefully-engineered design and construction details. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

SHARPE

B·S

for drilling three 1/2-inch holes in a joint face, drilling and spot-facing two 17/32-inch holes, and drilling and spot-facing one 15/32-inch hole in a steering-gear housing bracket at a production rate of 327 pieces per hour. 73

New Line of DoAll "Utility" Band Saws

A new series of 16-inch convertible model band saws has been introduced by the DoAll Co., Des Plaines, Ill. These machines range from the basic Model HS low-cost single-speed woodworking saw shown at the left in the accompanying illustration to the fully equipped Model SFP shown at the right.

The Model HS machine has one high set-speed or two four-speed step-pulley drives for cutting wood, plastics, leather, paper, etc. The Model HSV band saw (shown second from left) has a variable high-speed range of 850 to 5200 feet per minute for cutting aluminum, sheet steel, and light structural sections. Model LHV (shown third from left) has both low and high variable-speed ranges of 50 to 300 feet per minute and 850 to 5200 feet per minute, for cutting ferrous, as well as non-ferrous, materials and alloys. Model SFP has the same speed range as Model LHV, but includes equipment for filing and polishing operations, as well as for welding saw bands.

Rip fences and circle cutting, mitering, and contouring attachments are available for use on these machines. Either a 1/2- or a 3/4-H.P. driving motor can be furnished. 74

New Line of "Utility" Band Saws Brought out by the DoAll Co.

Colonial Broach-Sharpening Machines

A complete line of broach-sharpening machines comprising seven basic models has been announced by the Colonial Broach Co., Box 37, Harper Station, Detroit 13, Mich. The new line includes two sizes of machines for sharpening flat broaches; three for sharpening round broaches; and two sizes that will handle both flat and round broaches.

The flat-broach sharpeners will handle broaches up to 8 inches wide in lengths up to 32 and 65 inches, respectively, at one setting. The round-broach sharpeners will take broaches up to 6 inches in diameter in lengths up to 36, 72, and 84 inches. These machines are designed to handle all kinds of round broaches, including spline, serration, and other types. The two universal models will handle round broaches having diameters up to 6 inches in lengths up to 72 and 84 inches, respectively, and flat broaches up to 8 inches wide in lengths up to 65 and 77 inches.

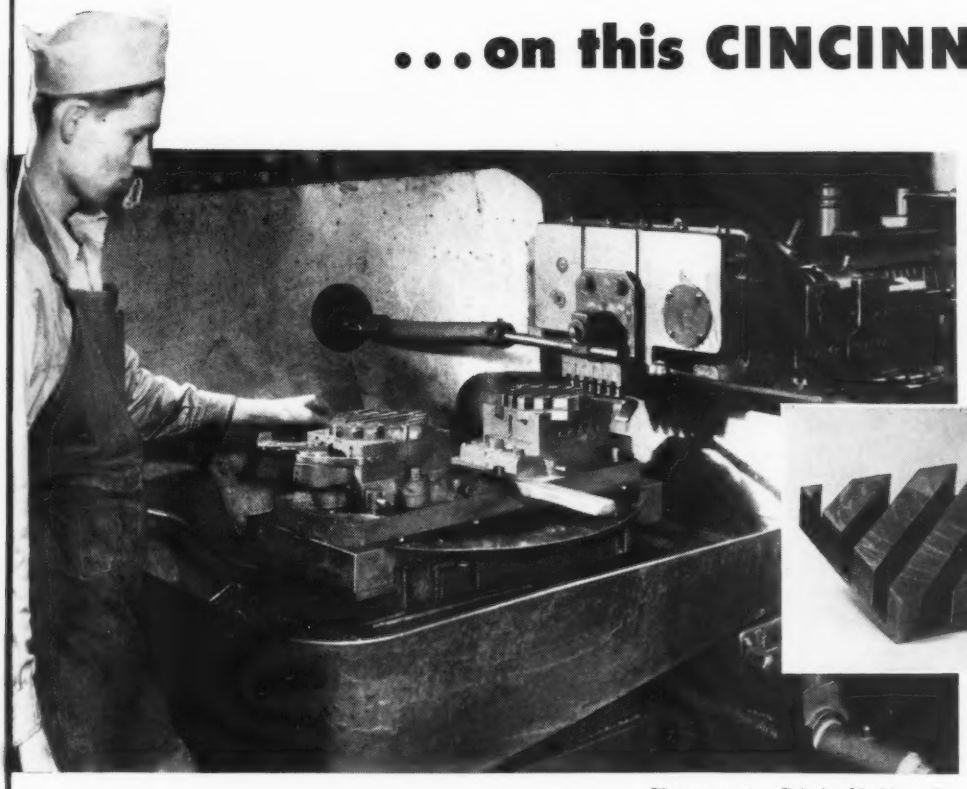
The grinding wheels and headstocks of the various machines are equipped with built-in motors. The spindles of the grinding wheels on all machines have a standard speed of 4000 R.P.M., which can be increased to a maximum of 10,000 R.P.M. through the use of special pulleys. Headstocks on the machines that sharpen the round broaches, as well as those on the universal models, have spindle speeds of 200 and 400 R.P.M. 75

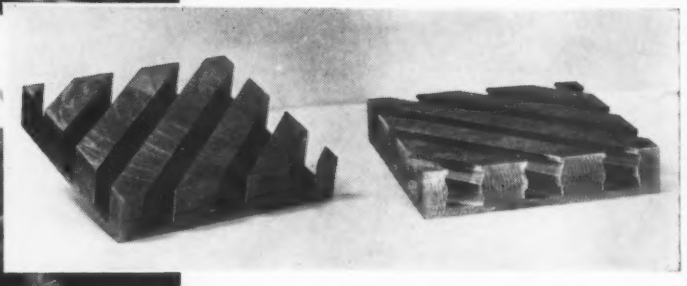
Universal Model Broach-sharpening Machine for Round and Flat Broaches, Brought out by the Colonial Broach Co.

To obtain additional information on equipment described on this page, see lower part of page 238.

90 pieces per hour

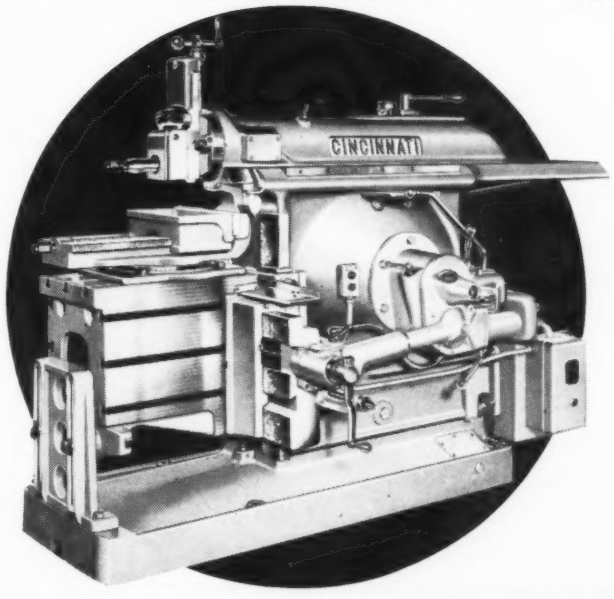
...on this CINCINNATI SHAPER





Work piece is a malleable iron, Warnock diagonal block. Rate of production, 90 per hour. Specially designed gang tool holder carries six form ground high-speed tools.

Photo—courtesy Printing Machinery Co.



This high production, special Cincinnati Shaper, designed by Cincinnati engineers, is completely automatic. With a comparatively low initial cost, and low cost of tooling, it gives a high return on investment.

The operator starts the machine; the head feeds nine strokes to right, nine to the left, and the Shaper automatically stops at rear position. The operator indexes the fixture and then starts another cycle. Loading and unloading are done while the Shaper is cutting.

Consult us on your shaping job, and the possibilities of a special Shaper.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

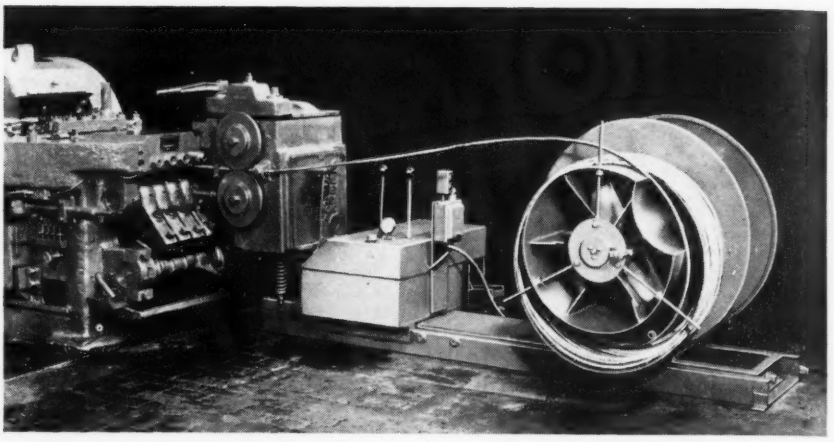
SHAPERS · SHEARS · BRAKES

Hydraulic Straightening Device for Heavy Coil Stock

A new hydraulic wire-straightener has been developed by the National Machinery Co., Tiffin, Ohio, for use with bolt-making, nut-forming, and other cold-heading equipment using heavy wire or coiled hot rods. The device is designed to reduce "down time" or the time required for feeding wire into the machine from a new coil by mechanically straightening a sufficient length of wire to pass through the feed-tube and rolls, and by pushing the straightened length into the machine.

The straightening device has a double wire reel and a car that travels on a track frame. The two drums which hold the wire coils can revolve on a shaft held stationary in a spindle head mounted on the car. Gripping bars, or heavy jaws with V-grooves, are mounted on one end of the stationary track frame. Both the car and the gripping bars are hydraulically actuated.

The butt end of the wire to be straightened is placed in the gripping bars. The car holding the coil moves the length of the track, thus straightening a long length of wire. When one coil has been consumed, the reel head is turned 180 degrees, bringing the second coil into the operating position. The straightened length of wire is then brought into place for feeding and the car is advanced, forcing the wire into the header.



Straightening Device for Heavy Coil Stock Made by National Machinery Co.

These straightening devices are made in three sizes, for handling wire diameters up to 3/4 inch, 1 1/4 inches, and 1 1/2 inches...76

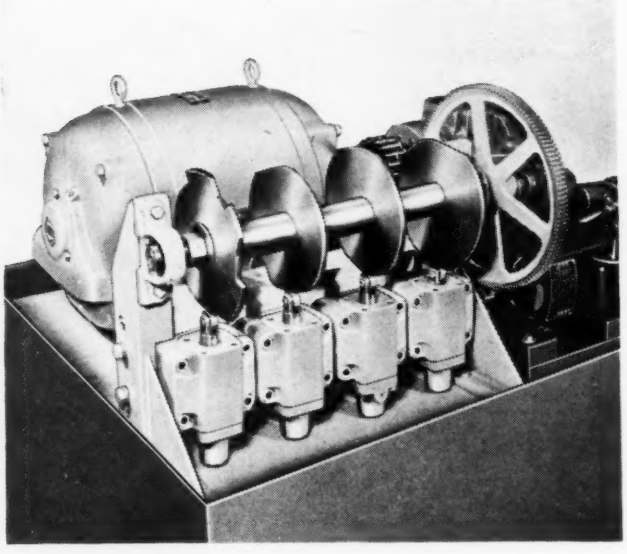
Hufford "Mechanical Brain" for Controlling Hydraulic Equipment

The "mechanical brain" originally brought out by the Hufford Machine Works, Inc., Redondo Beach, Calif., for use with Hufford hydraulic presses is now available for application to widely varying types of hydraulic equipment. It is designed to produce a series of perfectly timed repetitive motions of multiple rams operated by hydraulic cylinders. A number of specially designed cams, machined for specific operations, are mounted on a single shaft to obtain the desired control. The camshaft is motor-driven through a hydraulic transmission. Infinite variation of speed is obtained with this equipment.

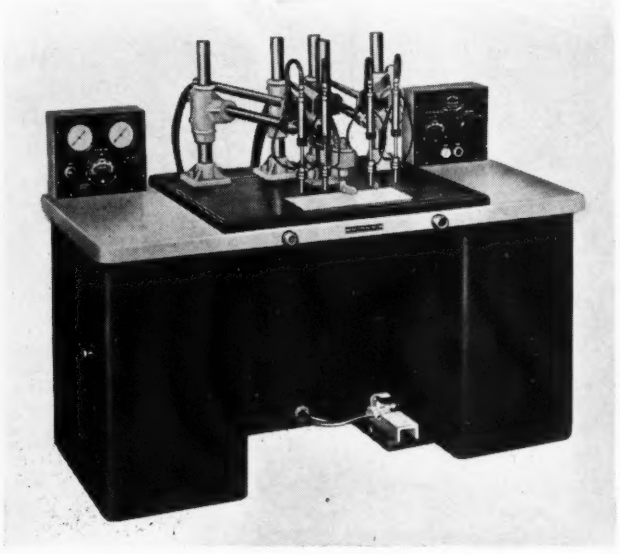
As the cams rotate, they depress the stems of actuating valves, thus starting or stopping the flow of the hydraulic fluid to the operating cylinders. The number of cams employed is determined by the number of cylinders to be controlled. 77

Graham Welding Machine Using Tip-Stud Process

The basic principle of a new welder brought out by the Graham Mfg. Corporation, 1643 National Bank Bldg., Detroit 26, Mich., is a capacitor-operated self-timing device using tip-studs which, on coming in contact with the work



"Mechanical Brain" Mechanism Developed by Hufford Machine Works for Controlling Hydraulic Equipment



Machine Employing Stud-welding Process, Placed on the Market by the Graham Mfg. Corporation

To obtain additional information on equipment described on this page, see lower part of page 238.

4-Man Shop with a FUTURE

● This small shop houses a successful and growing business due to continuous high standards of accuracy.

Quality equipment pays the small operator as well as the large.

The Schoening Machine Service, 3284 Dunn Street, Cincinnati, Ohio—business, production machining—small in size—big in accomplishment—testifies to the value of fine tools.

The Cincinnati Bickford Super Service Upright Drill, illustrated, is drilling five $\frac{11}{32}$″ holes and four $\frac{11}{32}$″ holes to a plus or minus .005″ tolerance in a steel cover $\frac{5}{16}$″ thick—a production job.

Mr. Schoening tells us he has held accuracy to a plus or minus .0002″ on production reaming jobs.

Write for Bulletin No. U-25.

THE CINCINNATI BICKFORD TOOL CO.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Radials 7½″ dia. col., 2½′ arm, to 26″ dia. col., 12′ arm.
General purpose Uprights, 21″ to 28″ sizes.
Production Uprights, 21″ to 28″.
Jig Borers, Portable Horizontals, Spacing Table Machines.

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

and fusing, cause ionization. The ionization, in turn, provides a path for the main discharge current of the capacitor, which forms an arc of sufficient intensity to melt both the full section of the stud end and the work directly under it. This action is followed by the necessary hammer blow, which causes the pieces to become welded together. The complete cycle is brought about by a rapid continuous movement of the stud-holding part.

Some of the advantages of the extremely short arc time are concentration of heat, welding of studs on very thin metal, absence of fillets, no distortion of work, and no discernible heat. Studs can be welded on the back of plated or painted surfaces without marring them. No flux is necessary, and dissimilar metals can be joined by welding. Studs up to 1/2 inch in diameter can be welded. Both portable and stationary units are available. 78

Hauser Pivot-Polishing Machine

A line of pivot-polishing machines designed to meet the exacting requirements of instrument, meter, and clock and watch manufacturers is being built by the Hauser Machine Tool Corporation, 74 Bournedale Road, N., Manhasset, N. Y. These machines can be employed for polishing both hard and soft pivots, and can be quickly and accurately adjusted for high-precision work.

They are especially intended for polishing pivot bearing surfaces after they have been turned or ground close to size, about 0.0004 to 0.0008 inch being left on the diameter for polishing. A tungsten-carbide wheel is used. Hard steel parts can be given a mirror-like finish. An excellent finish can also be given soft steel and bronze parts. Shoulders and cylindrical surfaces can be polished in one operation. Tapered angles and radii can also be polished. The time required for the operation varies from 3 to 45 seconds, according to the work diameter and the reduction in size.

The work-spindle runs at 1750 R.P.M. When the work is held in a collet, the spindle is direct-driven. The polishing wheel or lap, which runs at 620 R.P.M., and the quill form a unit that can be easily removed from the machine for regrinding.

The machine shown in Fig. 1 is equipped with a lubrication pump. This machine will polish work having a minimum diameter of 0.004 inch and a maximum diameter of 0.197 inch. It will polish surfaces up to 1.197 inches in length on work up to 5 inches long. The machine illustrated in Fig. 2 has an automatic release feature which controls the duration of the polishing operation and the pressure applied, thus enabling the operator to control several machines. This machine will accommodate work of the same diameter as the one shown in Fig. 1, but will polish surfaces only up to 0.315 inch long. 79

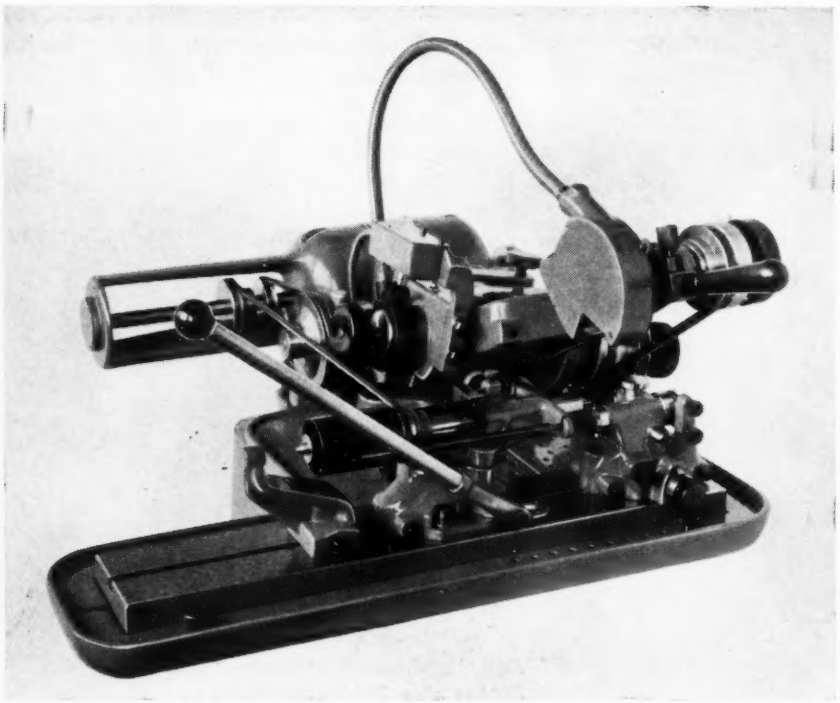


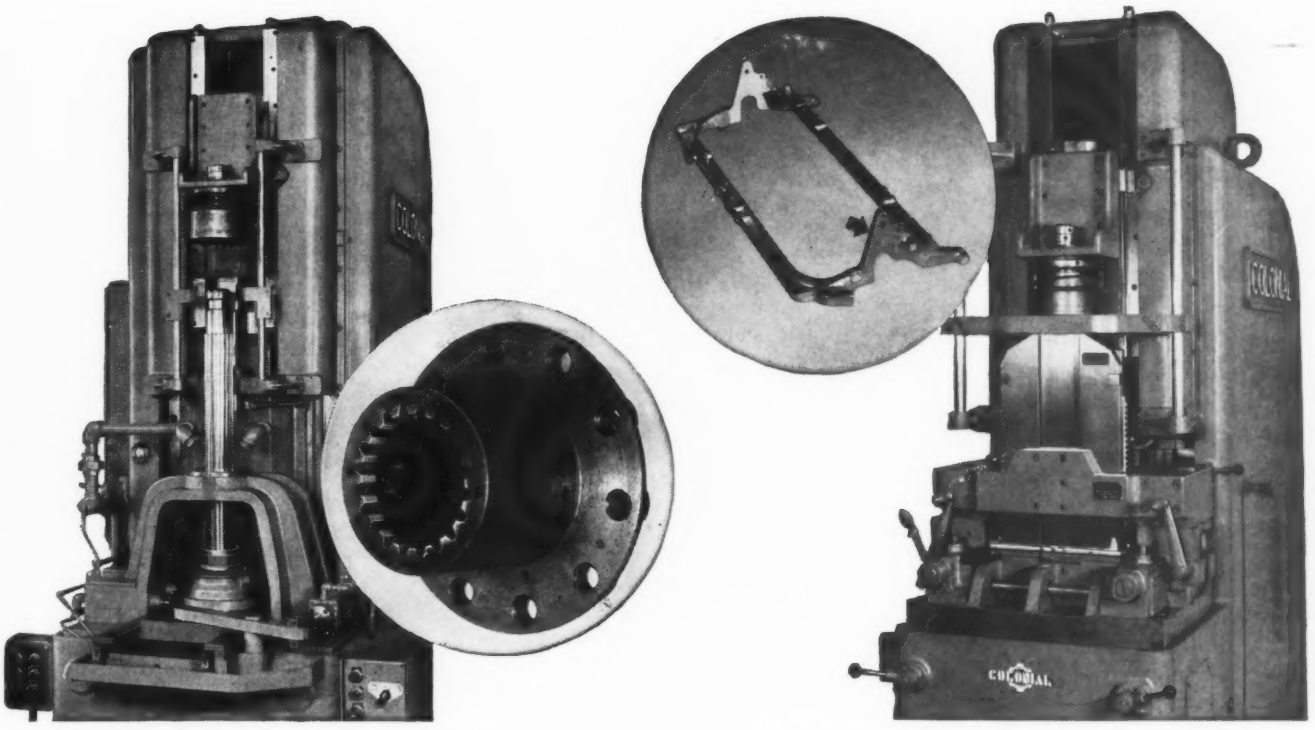
Fig. 1. Hauser Pivot-polishing Machine with Lubrication Pump

Fig. 2. Hauser Pivot-polishing Machine with Automatic Release

Airco Arc-Welding Electrode

The Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y., has brought out a new No. 394 low-hydrogen type coated electrode designed to prevent under-bead cracking in weld deposits. This electrode operates on either alternating or direct current and is said to produce welds having a tensile strength of 100,000 pounds per square inch. It will serve as the high-tensile companion electrode to Airco No. 312, which is used on mild steel to produce a tensile strength of 60,000 pounds per square inch. 80

To obtain additional information on equipment described on this page, see lower part of page 238.



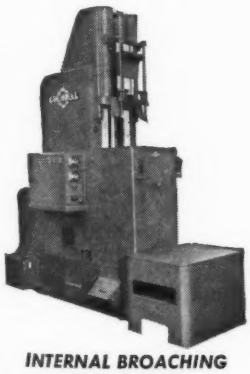
HEAVY STEEL WHEEL HUBS ---or--- LIGHT WEIGHT TYPEWRITERS

They're all the same to versatile high speed Colonial Broaching Machines

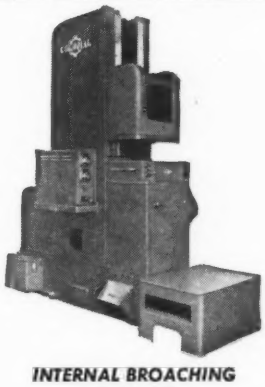
PIONEERS OF H.S.S. BROACHING
COLONIAL
BROACH CO. DETROIT 13
BEST BY TEST

Shown here are two Colonial Pull-down broaching machines. They're fundamentally alike, but one has the job of broaching 8-pitch splines in a forged steel wheel hub, while the other broaches the inside faces of lightweight aluminum typewriter carriage frames. Automatic broach handling, complete guiding of broaches above and below the part, and high accuracy are characteristic of both of these standard Colonial machines. Of course there is a difference in machine capacities. One is a six, the other a 15 tonner. We'll be glad to tell you whether production cost of your parts can be cut and output rate increased on one of these or other types of the latest Colonials.

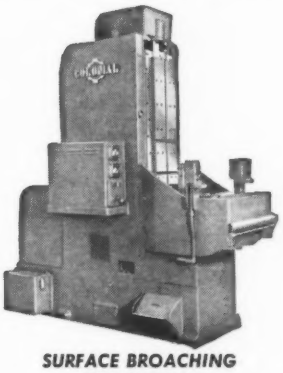
Have you seen these new Colonials? Ask for Bulletins describing them!



INTERNAL BROACHING
PULL-DOWN
BULLETIN NO. RD-48



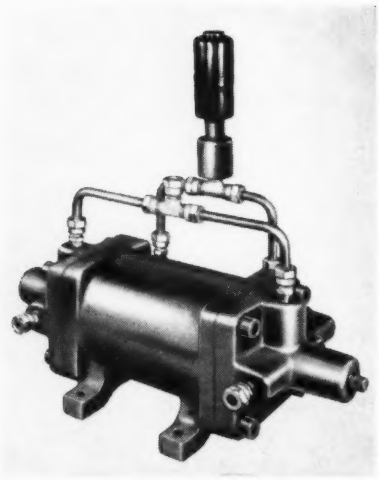
INTERNAL BROACHING
PULL-UP
BULLETIN NO. RU-48



SURFACE BROACHING
SINGLE-RAM
BULLETIN NO. RS-48

ALSO:

Colonial Dual-Ram surface broaching machines, Broaching Presses and Universal Horizontal Broaching Machines.



"Power-petuator" Unit for Operating Small Hydraulic Presses

Elmes "Power-petuator" for Operating Small Hydraulic Presses

The Elmes Engineering Works of American Steel Foundries, 1002 Fulton St., Chicago 7, Ill., has just announced an air-actuated continuously charging intensifier, known as the "Power-petuator," which provides a continuous high-pressure stroke and maintains pre-set ram pressures when used on any "Hydrolair" press. This equipment is designed to give the users of the small "Hydrolair" presses the advantages of hydraulic power without the usual motors and pumps. Typical applications are molding plastics and rubber; laminating and assembling; forming and gluing; repetitive testing operations; and other work requiring pressures up to 50 tons.

The "Power-petuator" is completely automatic. With the machine controls in the "press" position, it builds up working pressure virtually instantaneously. Air requirements are negligible.

The "Power-petuator" is a self-contained unit which can be placed out of the way at the rear of the bench type "Hydrolairs" or in the base of floor type machines. The ram pressure is adjusted to meet requirements by means of an air-pressure regulating valve. 81

Buffing and Polishing Machines and Heavy-Duty Grinder

The Standard Electrical Tool Co., 2500 River Road, Cincinnati 4, Ohio, has incorporated a jack-shaft in its line of infinitely variable speed buffing and polishing machines which is constructed as shown in Fig. 1. This jack-shaft provides for an infinitely variable low-speed range or a two-in-one arrangement for obtaining both the low- and the high-speed ranges. The conventional buffer-polisher has a speed range of 1500 to 3000 R.P.M. through the "Speedial" control. With the machine shown in Fig. 1, there is available an infinitely variable speed range of 600 to 3600 R.P.M.

A machine similar to the one illustrated can be furnished for the infinitely variable slow speed range only, in any 2 to 1 ratio—for example, 600 to 1200 R.P.M., 700 to 1400 R.P.M., etc. The machine shown in Fig. 1 is equipped with a 3-H.P. motor, enclosed spindle, and four ball bearings. It is also available in 1- and 2-H.P. sizes with two ball bearings and open spindle construction.

The 7 1/2-H.P., 20-inch grinder shown in Fig. 2 has been added to this company's "Cadet" line of heavy-duty grinders. The new machine is ball-bearing equipped, and the guards are of structural plate steel and adjustable for wheel wear. Each guard has a hinged door, exhaust outlet, and adjustable spark breaker. 82

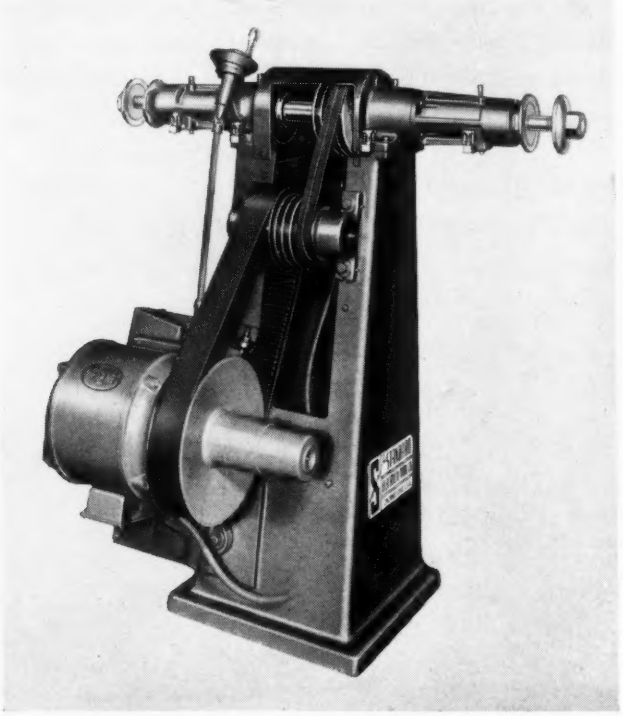


Fig. 1. Infinitely Variable Speed Buffing and Polishing Machine with Jack-shaft Construction, Brought out by Standard Electrical Tool Co.

Fig. 2. Ball-bearing Equipped Machine Recently Added to the "Cadet" Line of Heavy-duty Grinders Built by the Standard Electrical Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 238.

BALANCING

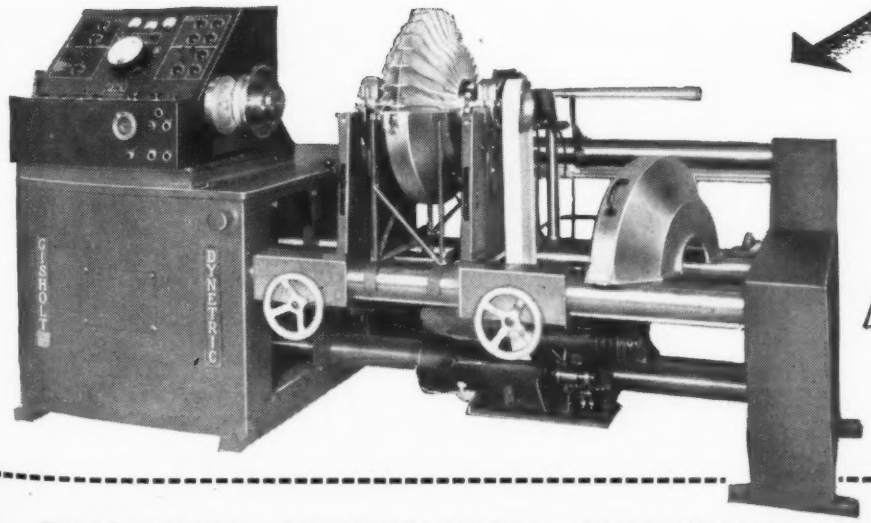
keeps pace with the jets!

Racing into the terrifying regions bounded by the speed of sound, the jet planes have also opened new frontiers in engineering. For example, the requirements for accurate balancing exceed all previous commercial standards. At the fabulous operating speeds of the turbo-jet impellers, the slightest vibration caused by unbalance can spell disaster.

It is significant that builders of American jet engines have turned to Gisholt Balancers for the unfailing accuracy required in this important work.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin



Gisholt DYNETRIC Type U Balancer, shown at left, can measure unbalance vibrations as small as 20 millionths of an inch on these turbo-jet compressor impellers.

DYNETRIC BALANCERS — GISHOLT

DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION
"DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

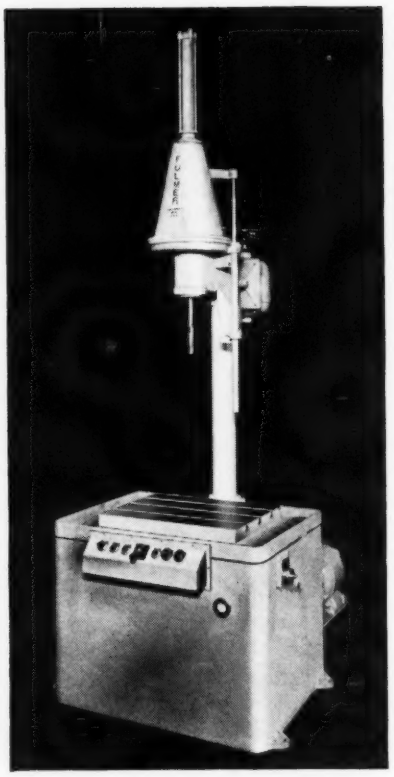
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Milwaukee Filing Machine Equipped with All-Purpose Over-Arm

A bench type Milwaukee die filing machine designed to perform sawing and lapping, as well as filing operations, without changing over-arms, is being manufactured by the Rice Pump & Machine Co., Milwaukee, Wis. The versatility of this machine is provided by a new deep-throated over-arm equipped with a chuck which holds files, saws, or lapping sticks at the upper as well as the lower end.

Spring tension on saws and thin files is readily adjusted by moving the chuck assembly up or down. The new over-arm also permits chucking close to the work-piece, thereby assuring maximum rigidity of saws and files. The lower chuck has a ball joint which permits accurate alignment of files with warped, crooked, or twisted shanks before they are rigidly clamped in the working position.

The over-arm can be instantly released and swung clear of the table to permit inspection and checking of the work. An adjustable stop assures immediate return to the original setting. The work-table is mounted on two brackets, and can be tilted 15 degrees in any direction for filing or sawing of compound angles. A hold-down finger clamps the work flat against the table in any desired position. 83



Fulmer Small-size Hydraulic Honing Machine

Fulmer Hydraulic Honing Machine

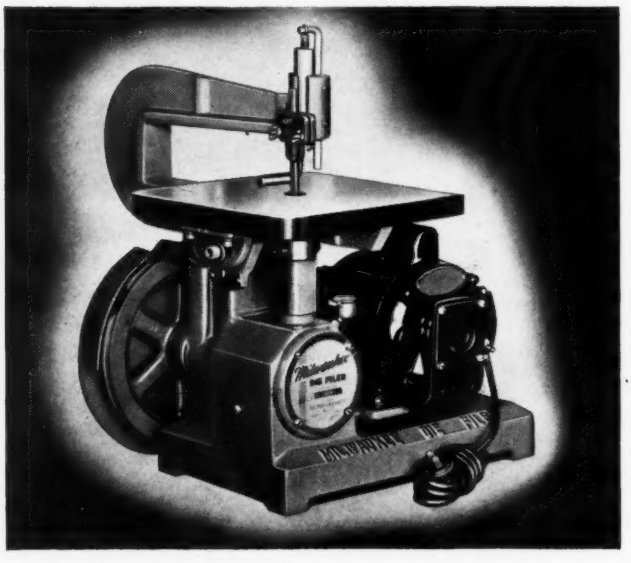
The C. Allen Fulmer Co., First National Bank Bldg., Cincinnati 2, Ohio, has added a small single-spindle vertical hydraulic honing machine to its line. The new machine has been developed for both general-purpose work and production runs on small parts. It is designed for rapid, accurate honing of any type of internal cylindrical surfaces 1/2 inch to 4 inches in diameter, such as aircraft and automobile cylinders, refrigerator compressor cylinders, connecting-rod bores, bearing housings, drill bushings and ball-bearing races.

The machine has a maximum honing stroke of 12 inches obtained by means of a hydraulic cylinder which provides any reciprocating speed from 0 to 80 feet per minute, regardless of the length of the stroke setting.

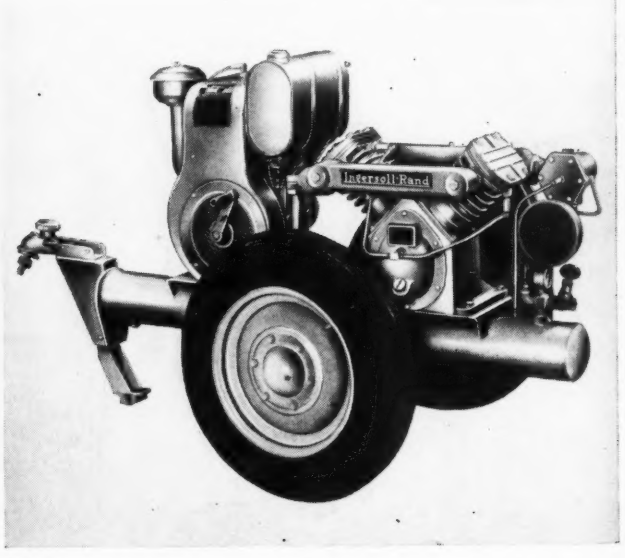
Hydraulic power is supplied by a Vickers vane pump driven by a 3-H.P. motor, the spindle being driven by a separate 3-H.P. motor. Three spindle speeds are obtained through cone pulleys and a heavy-duty V-belt, the output pulley driving alloy-steel reduction gears equipped with over-size Timken bearings. The gears and bearings run in a constant bath of oil with oil seal protection. Any conventional type honing tool can be mounted on the 1 1/4-inch diameter spindle, which has a No. 3 Morse taper nose. The working table is 18 by 24 inches. The machine occupies a floor space of 41 by 48 inches, is 100 inches high, and weighs 2500 pounds. 84

Portable Air Compressor

A recent addition has been made to the line of portable air compressors manufactured by Ingersoll-Rand, 11 Broadway,

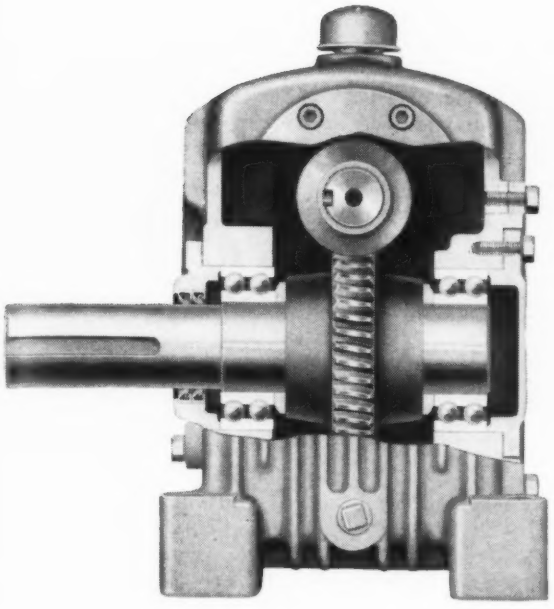


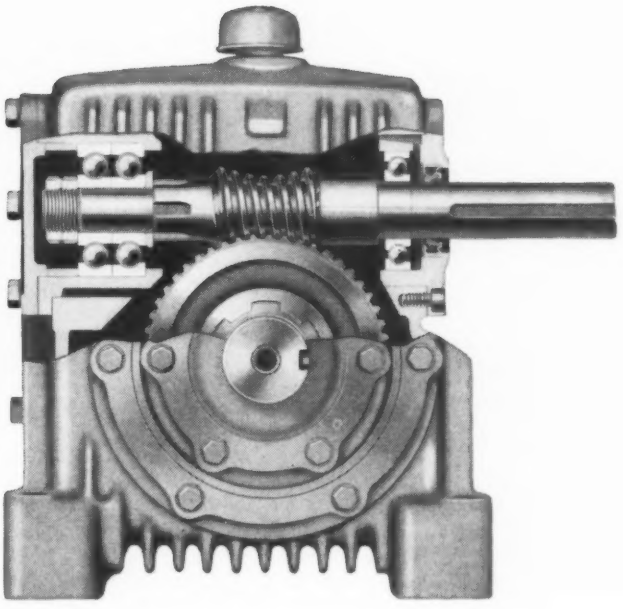
Milwaukee Die Filing Machine Manufactured by the Rice Pump & Machine Co.



Portable Gasoline-engine Driven Compressor Made by Ingersoll-Rand

To obtain additional information on equipment described on this page, see lower part of page 238.





HOW WOULD YOU LIKE TO TRANSMIT...

3 HP with a 2" GEAR*SET?

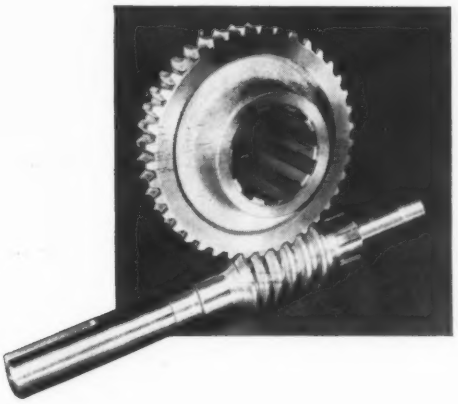
632 HP with an 18" GEAR*SET?

*CENTER DISTANCES

Impossible? These are the actual ratings of some Cone-Drive gear sets at 1750 rpm. The larger gear set can actually handle 600,000 INCH POUNDS of torque at 100 rpm.

These *standard* Cone-Drive gear sets and speed reducers—with their greater contact per tooth and MORE TEETH IN CONTACT—are available in ratios of 5:1 to 70:1 and from fractional hp to hundreds of hp.

Write for complete information today, giving your approximate hp or torque and speed requirements.



CONE-DRIVE

CONE-DRIVE DIVISION MICHIGAN TOOL COMPANY
7171 E. McNichols Road • Detroit 12, U. S. A.

New York 4, N. Y., known as the "Pac-Air." This is an air-cooled, gasoline-engine driven unit with a two-cylinder, single-stage compressor that has a piston displacement of 37.5 cubic feet per minute at 80 pounds per square inch pressure. The compressor is equipped with an automatic unloader, and is mounted on an air receiver which forms an integral part of the running gear. 85

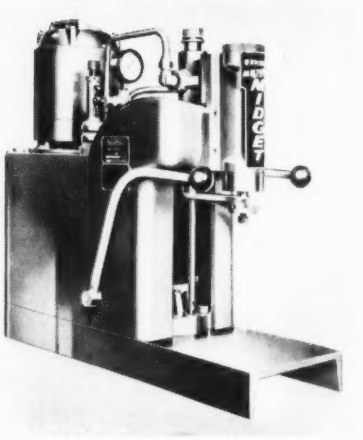
Grand Rapids Tap Grinder

The Gallmeyer & Livingston Co., 305 Straight St., S.W., Grand Rapids 4, Mich., has brought out a new line of tap grinders, including the Model 2D-1 shown in the illustration, which has a capacity for grinding taps from the No. 6 to the 3-inch size. This machine is of the double-end spindle type on which two taps can be ground at the same time.

This new machine will grind pipe, pulley, nut, and tapper taps, as well as hand taps and machine taps, having two, three, four, five or six flutes. Various thread forms, including S.A.E., A.S., V.S.A.E., Acme, and square forms can be ground. A special attachment for grinding bent-shank taps is available. Any desired angle of taper at the point of the tap can be ground. A diamond truing device with two diamonds is furnished as part of the standard equipment. The spindle is driven through V-belts from a 1 1/2-H.P. motor. The machine weighs about 900 pounds. 86

Prutton Thread-Rolling Machine

The D. H. Prutton Machinery & Tool Co., 5295 W. 130th St., Cleveland, Ohio, has designed a new rotary thread-rolling machine known as the "Rollmaster." This machine is said to attain production rates far surpassing any previously obtained in performing such operations as ribbing, knurling, marking, and necking, as well as threading, primarily because no time is lost through the operation of reciprocating movements. Any of the operations mentioned can be performed on bolts and studs up to 1/4 inch in diameter at rates between 15,000 and 20,000 pieces per hour. 87

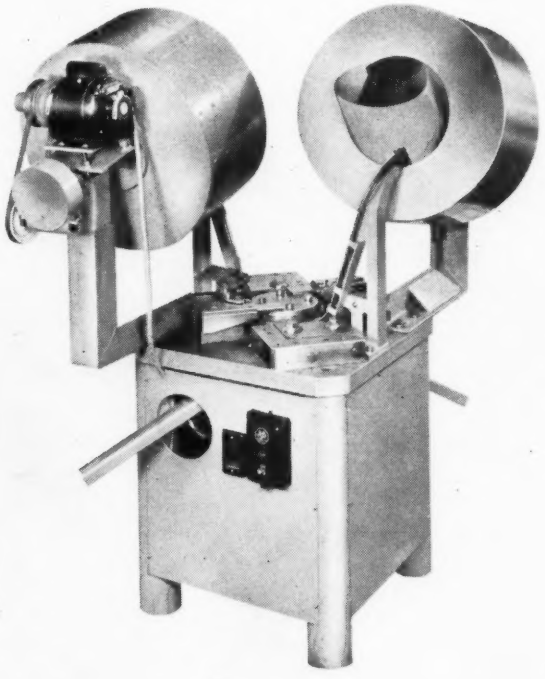


"Midget" Packaged Multipress Unit

Denison Midget Multipress Packaged Unit

The Denison Engineering Co., 1160 Dublin Road, Columbus 16, Ohio, has made available, in a completely packaged unit, its new "Midget" Multipress. This is a multi-purpose, oil-hydraulic press of 2000 pounds capacity, complete with its own pumping equipment. The ram speed and pressure can be regulated by controls at the operator's fingertips. This unit can be switched rapidly from one job to another.

Grand Rapids Tap Grinder Brought out by the Gallmeyer & Livingston Co.



"Rollmaster" Thread-rolling Machine Made by D. H. Prutton Machinery & Tool Co.

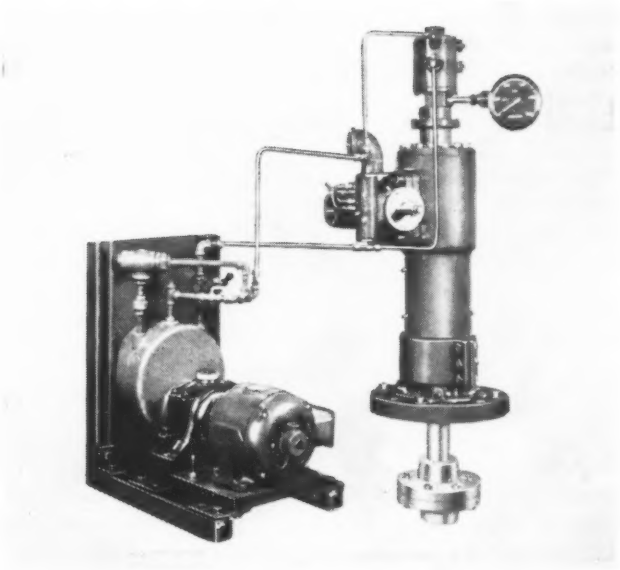
To obtain additional information on equipment described on this page, see lower part of page 238

The press measures 13 by 30 by 29 3/4 inches, and weighs only 270 pounds. The stroke is 6 inches, throat depth 4 5/8 inches, and maximum daylight opening 15 3/8 inches. The return speed of the ram is 600 inches per minute, and the working speed is 400 inches per minute. 88

Variable-Speed Hydraulic Drives

A line of variable-speed hydraulic-drive systems has been introduced by the Hydraulics Division of Rockwell Mfg. Co., 50 Water St., Pittsburgh 22, Pa. Rotocycle pumps and motors are used in these systems. Special mechanical seals are provided for pressure-vessel applications. Motors can be remotely located from the pumps and the hydraulic circuit arranged so that several motors are supplied by one pump.

A "Hydro-syn" governing system is used to maintain a predetermined speed. This system can be used to maintain any predetermined condition of speed, torque, pressure, volume, or liquid level. Drives can be furnished in speed ranges up to 5000 R.P.M. and in ratings from fractional to 125 H.P. 89



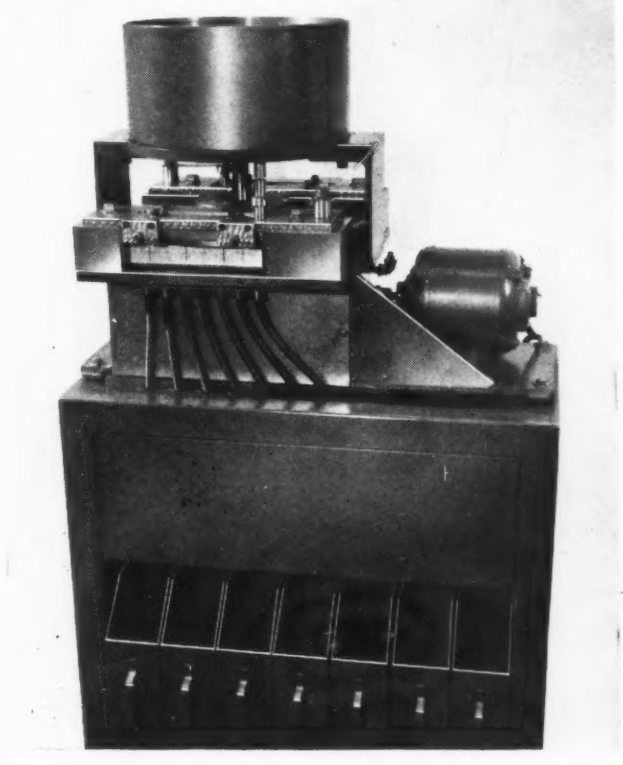
Variable-speed Hydraulic Drive with Mechanical Seal

Automatic Ball-Gaging Machine

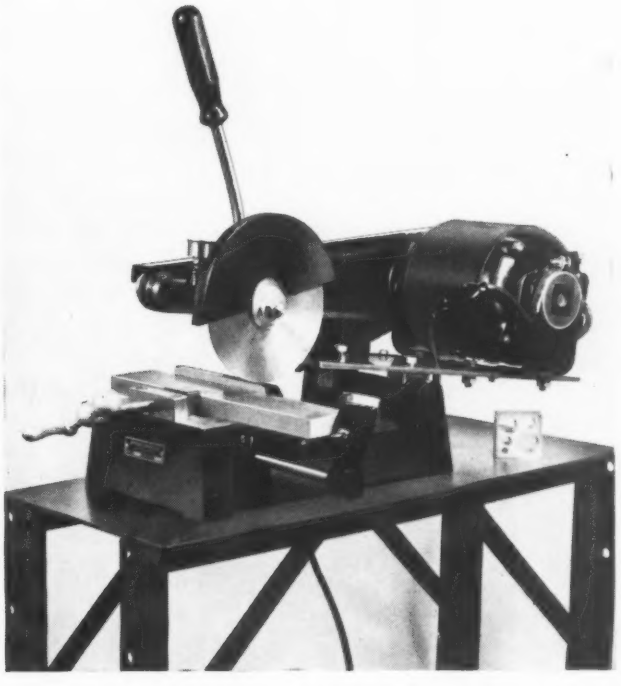
Two sizes of rotary machines for automatically gaging balls have been introduced by Koehler & Sons, Summer Ave., Horsham, Pa. One machine will gage balls from 1/32 to 1/2 inch in diameter at rates from 52,000 to 15,000 per hour, depending upon the ball size. The other machine is for balls from 1/2 to 3/4 inch in diameter, and inspects 5000 balls per hour. A dual set of gages maintains accuracy of the ball diameters within 0.00005 inch. 90

Portable Light-Duty Cut-Off Machine

The Approved Devices Co., 525 Woodward Ave., Detroit 26, Mich., has developed a light-duty, port-



Automatic Machine for Gaging Ball Diameters



Light-duty Portable Cut-off Machine

To obtain additional information on equipment described on this page, see lower part of page 238.

able cutting-off machine designed for the rapid cutting of ferrous and non-ferrous metals, plastics, and other materials.

The machine can be equipped with a 1/3-H.P., 110-volt, 60-cycle, single-phase alternating-current motor and an abrasive wheel 6 inches in diameter by 1/16 inch thick. Attachments are available for cutting at an angle of 45 degrees or any other angle desired. The machine has a length of 24 inches, a width of 10 inches, and a height of 11 inches; it weighs 53 pounds when equipped with motor. The spindle speed is 5800 R.P.M., giving a surface speed of 9100 feet per minute with a 6-inch wheel. 91

Snyder Special Machine for Center-Drilling and Facing Automotive Parts

The Snyder Tool & Engineering Co., E. Lafayette, Detroit 7, Mich., has brought out a special-purpose machine for center-drilling and facing automotive pistons, which enables an unskilled operator to produce 444 pistons an hour at an operating efficiency of 85 per cent. The machining operation consists of center-drilling the head end of the piston and facing a portion of the piston-head. The surfaces thus finished serve as locating points for succeeding operations.

The hydraulically actuated slide units, which carry single-spindle heads, are used for the center-drilling operation. Facing slides and tool-blocks are mounted on the face of the machine column and are hydraulically actuated in the horizontal position. Two rotating, four-jaw chucks are mounted in the machine base directly beneath the centering spindles. Two of the four jaws of each chuck have radial locators. The jaws are hydraulically actuated, and the chucks are equipped with a height locator which contacts the inside of the piston-head, and thus controls the thickness of the piston-head during the top facing operation.

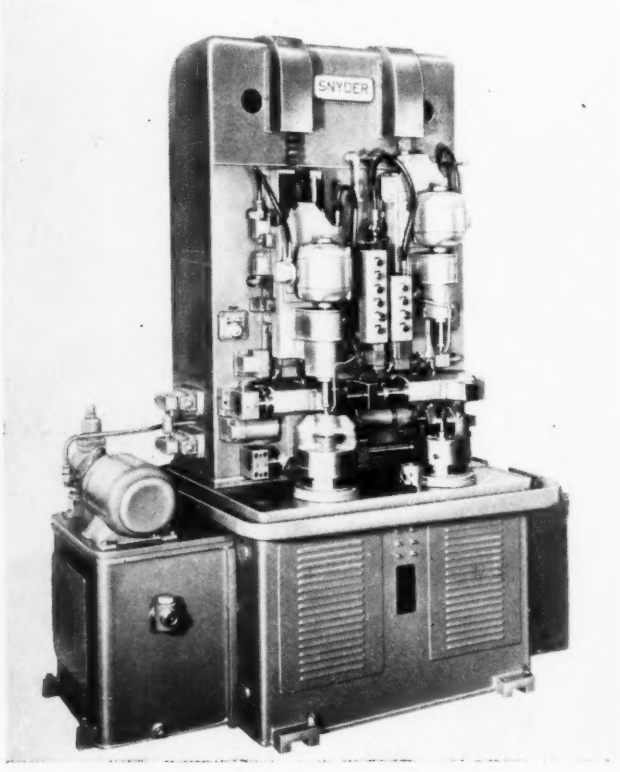
Each cross-slide has an independent hydraulic feed system, which permits the operator to load and unload a piston at one side of the machine while a piston is being machined at the opposite side. 92

Dry-Grinding Belt

A new "Resinall Metalite" cloth grinding belt, in which a special heat-resistant, thermal-setting resin adhesive is used, has just been announced to the metal-working industry by the Behr-Manning Corporation, Division of Norton Co., Troy, N. Y. This new abrasive dry-grinding belt is said to give increased production and to remain sharper for a longer period of time. 93

Acme Welding Machine

The Acme Electric Welder Co., 2618 Fruitland Road, Los Angeles 11, Calif., has announced a new air-operated, press type, direct-action projection welder designed for rapid, economical operation on light work. This machine can be supplied in 20-, 30-, or 40-KVA capacities. It has a standard throat length of 6 inches, but when converted for spot-welding by the application of adapters or horns, the throat length can be increased an additional 6 inches. This combination projection and spot welder is adapted for use in manufacturing plants and contract jobbing shops. 94



Special Machine for Processing Automotive Pistons, Built by Snyder Tool & Engineering Co.

Acme Projection Welder Set Up for Welding a Stud in a Stainless-steel Cover

To obtain additional information on equipment described on this page, see lower part of page 238.

Why "M-11" produces

MORE TAPPED HOLES PER TAP

M-11 is a chrome-cobalt high speed steel used exclusively by Detroit Tap and Tool Company for taps, thread gages and thread milling cutters. Some of the reasons for its use are:

COBALT . . . **Takes the human element out of hardening. THIS MEANS THAT UNIFORM HEAT-TREAT CAN BE OBTAINED AUTOMATICALLY!**

Increases the red hardness over ordinary HSS. THIS MEANS M-11 TAPS ARE HARDER, TOUGHER AT OPERATING TEMPERATURES.

CHROMIUM . **Increases toughness and strength of steel after heat treatment. THIS MEANS LESS BREAKAGE.**

Causes hardness to penetrate deeper and more uniformly. THIS MEANS SAME QUALITY AFTER AS BEFORE SHARPENING.

Resists corrosion. PROTECTS TOOLS IN TOOL ROOM. ALLOWS GREATER LATITUDE IN COOLANTS.

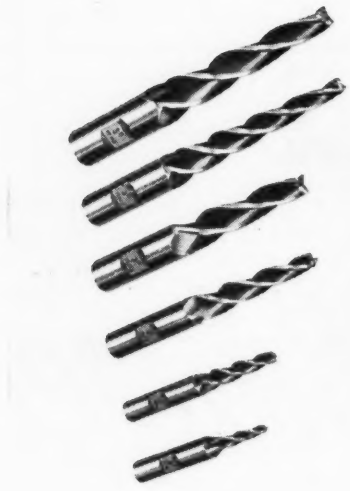
Provides greater resistance to abrasion. THIS MEANS MORE PIECES PER SHARPENING, MORE THREADS PER TAP.

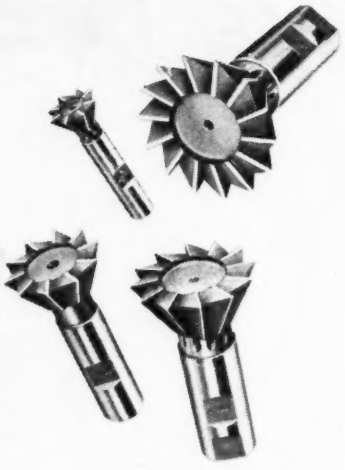
This combination of chromium and cobalt in Detroit Tap's M-11 high-speed steel is available to you at no increase in cost over quality taps made of ordinary high-speed steels. And back of every M-11 tap, thread gage and thread milling cutter is Detroit's SERVICE — a service which can make the proud claim:

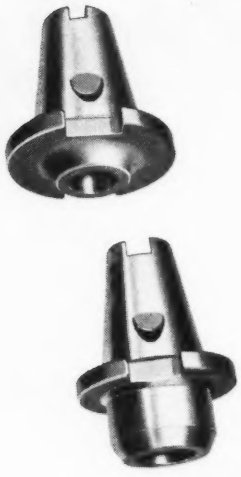
WE'VE NEVER "SHUT DOWN" A LINE YET!!

The Home of
"M-11" CHROME-COBALT HSS TAPS, THREAD MILLING CUTTERS & THREAD GAGES

DETROIT
TAP & TOOL CO.
8432 BUTLER STREET • DETROIT 11, U. S. A.







Weldon Tapered End-Mills, Angular Cutters, and Quick-Change Holders

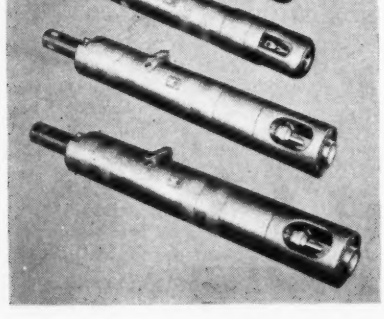
Three new products recently developed by the Weldon Tool Co., 3000 Woodhill Road, Cleveland 4, Ohio, include: (Left) Three-fluted tapered end-mills or die-sinking cutters of constant-spiral type for use in manufacture of molds and dies. Sizes range from 1/8 to 1/2 inch at small end and tapers from 1/2 degree to 7 degrees on side. (Center) Shank type 60-degree angular cutters for cutting dovetails. Regularly made in four sizes ranging from 3/4 inch to 2 1/4 inches in diameter, with shank sizes from 3/8 to 1 inch in diameter, for use in Weldon end-mill holders. (Right) Quick-change holders made with steep non-sticking tapers on outside and Morse No. 3 or 4 taper on inside for use with Weldon quick-change adapter. 95

Keller Multiple Drilling Units

Five "Airfeedrill" units manufactured by Keller Tool Co., Grand Haven, Mich., for multiple drilling work provide thirty-four speed combinations of stationary and portable units for drilling holes up to 3/4 inch diameter in mild steel, aluminum, brass, or plastics. The smallest tool weighs only 3 1/2 pounds, while the largest one weighs 28 pounds. The "Airfeedrill" is a combination of a Keller air drill, an air cylinder, and a hydraulic dashpot and feed control, assembled in one housing for quick or permanent locking in a jig or fixture. 96

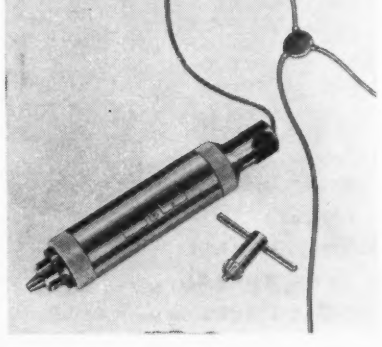
L & R Hand-Piece for Flexible-Shaft Machines

New quick-detachable radial hand-piece with Jacobs chuck for flexible-shaft machines, recently announced by L & R Mfg. Co., 577 Elm St., Arlington, N. J. Can be used on L & R line of flexible-shaft units or with units made by other manufacturers. The hand-piece consists of a two-piece aluminum housing with two pre-sealed ball bearings. The No. 0 Jacobs chuck has a capacity range of 0 to 5/32 inch. Hand-piece is 5 1/4 inches long by 1 1/16 inches in diameter. 98

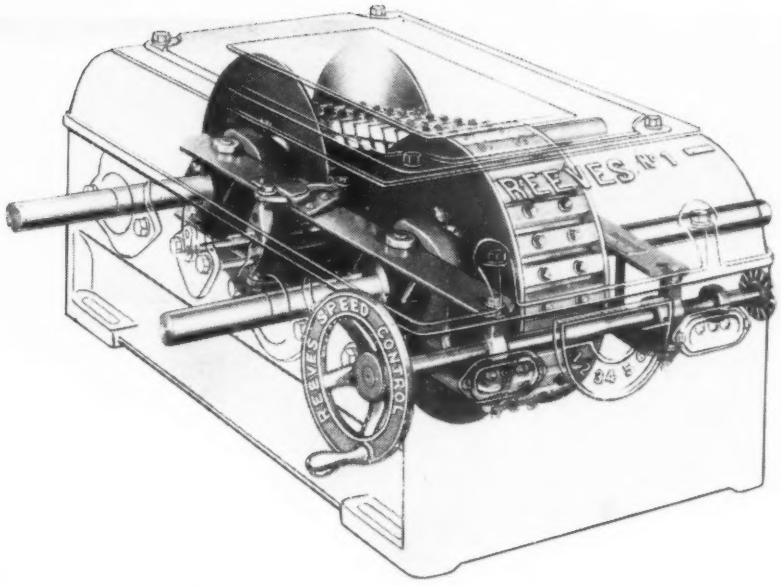


Bruning Whiteprinting Machine

New "whiteprinting" machine brought out by the Charles Bruning Co., Inc., 4754-22 Montrose Ave., Chicago 41, Ill., for the reproduction of engineering drawings and typed or written forms. Ink or pencil drawings and printed or typewritten forms on translucent or transparent material can be reproduced on light, medium, or cardweight papers. The machine exposes and develops regular Bruning papers, which can be selected to obtain black, blue, red, or brown lines on white backgrounds. Lines of the same colors can be produced on green, pink, or yellow tinted papers. . . . 97



To obtain additional information on equipment described on this page, see lower part of page 238.



Industry's Approved Method of Accurate, Variable Speed Control

The "missionary" work for variable speed control has been done. On every hand, in every industry where operating conditions are subject to change, there is abundant evidence to support its claims for increased output, improved, uniform quality and reduced cost.

Your problem, then, is one of selection . . . of determining which type and make of variable speed drive is best for your particular need. In making that choice, consider these facts about infinite, stepless REEVES Speed Control:

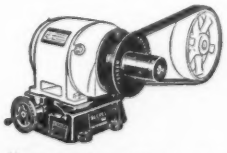
Manufactured by a company with more than fifty years' specialized experience in this specialized field. Design based on a proved operating principle. Ruggedly constructed for trouble-free operation and easy maintenance without special training or tools. Offered in a complete range of sizes, capacities and speed ratios, and furnished with any type of control . . . easily incorporated in new machine designs or applied to existing machines. Performance-proved in 260,000 installations and provided as standard equipment in 2,100 different makes of machines. Backed by a nation-wide engineering and service organization.

Think it over . . . this broad background of experience, this documented evidence of efficiency on any and all jobs . . . and we believe you will understand why REEVES is Industry's approved—*and proved*—method of variable speed control. Write for copy of 114-page catalog, M10-450A.

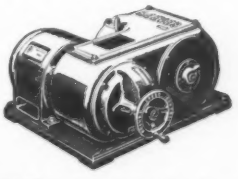
REEVES PULLEY COMPANY · COLUMBUS, INDIANA

THE THREE BASIC REEVES SPEED CONTROL UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive within 4:1 ratio. Sizes to 15 hp.

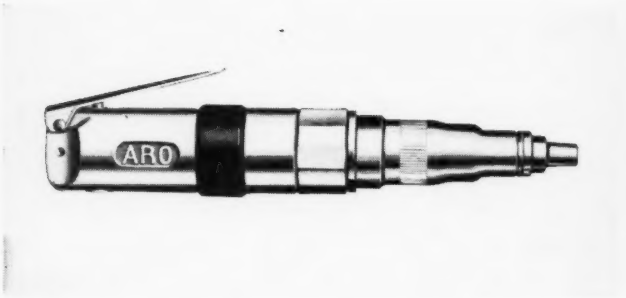


MOTODRIVE combines motor, speed varying mechanism and reduction gears in single compact unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 15 hp.

Accurate Variable

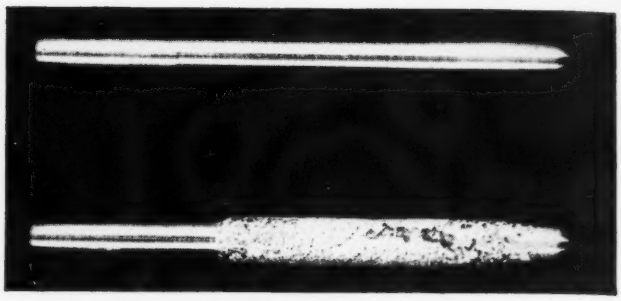
REEVES Speed Control

Gives the Right Speed for Every Job!



Pneumatic Screwdrivers and Nut-Setters

A new line of low-speed, high-torque air screwdrivers and nut-setters has been announced by the Aro Equipment Corporation, Bryan, Ohio. There are twelve new models having speeds ranging from 450 to 1100 R.P.M., including pistol and lever type air tools with a choice of positive or friction clutch. The slow speeds employed increase the life of bits and attachments, and are particularly suited to self-tapping screws and cross-recessed head screws. . 99

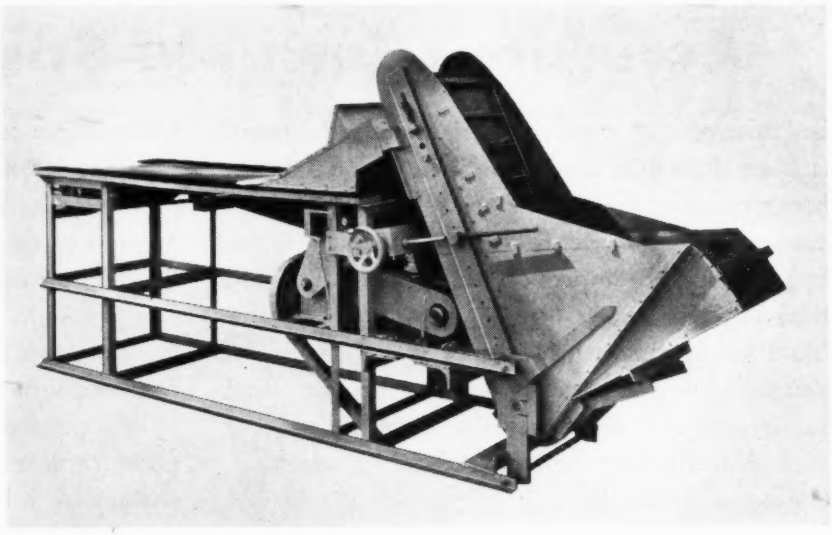


Sinclair Rust Inhibitor

Test pieces indicating effectiveness of RD-119 rust inhibitor developed by Sinclair Refining Co., 630 Fifth Ave., New York 20, N. Y. Lower steel bar shows heavy deposit of rust after immersion in ordinary kerosene. Upper steel bar remains completely rust-free after immersion for same length of time in kerosene containing 0.007 volume per cent of RD-119. Principal use of this rust inhibitor is for preventing clogging of gasoline and fuel-oil lines. . . . 100

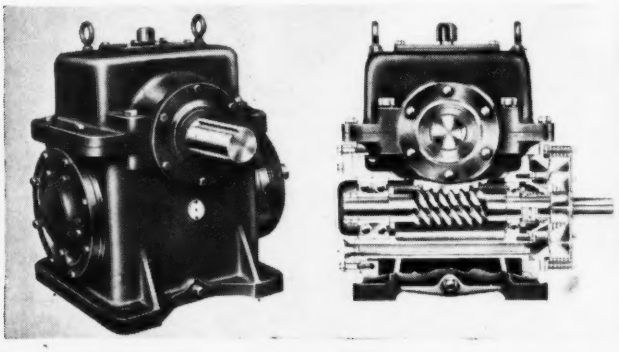
Inspection Table for Small Parts

Inspection table recently added to the line of products made by D. H. Prutton Machinery & Tool Co., 5295 W. 130th St., Cleveland, Ohio. An elevator hopper feeds any small mass-production item onto a 2- by 8-foot conveyor belt for visual inspection. A multi-speed transmission and a vertical angle control provide means for obtaining any desired distribution of the work on the inspection table. This new unit is especially adapted for inspecting small work, such as nuts, bolts, screws, studs, washers, and similar parts, at rates up to 130,000 pieces per hour. 101



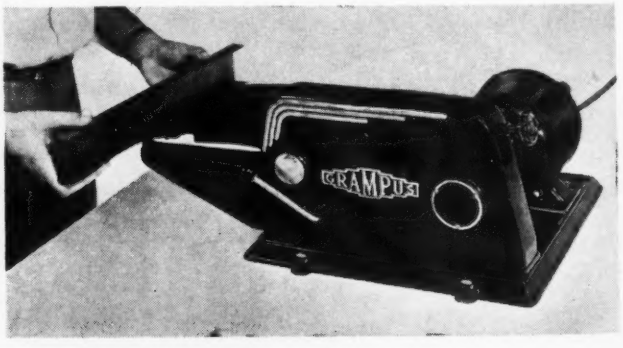
"Hypower" Enclosed Worm-Gear Drives

Horizontal enclosed worm-gear drives of new line of horizontal and vertical units made by Foote Bros. Gear & Machine Corporation, Chicago 9, Ill. These units comply with the speed ratio standards adopted by AGMA and NEMA. Thermal efficiency is increased by passing cool air through a channel cylinder immersed in the oil reservoir. New method of generating gears is said to give greater load-carrying capacity. 102



"Grampus" High-Speed Shear

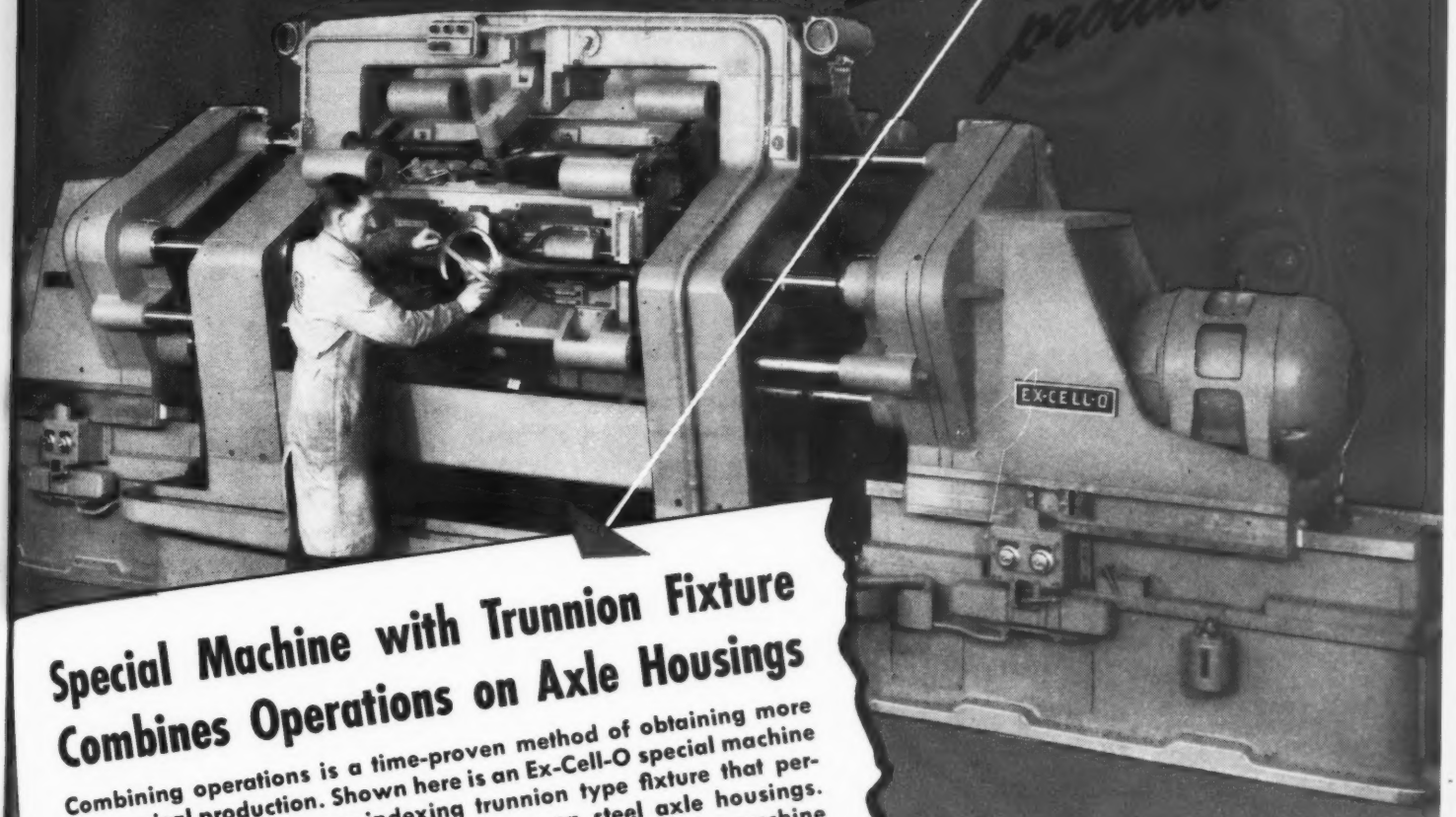
New "Grampus" high-speed, low-cost shear with unusually small head, designed to handle a wide variety of straight and contour cutting work. Has 2-inch lower horn, 7-inch throat depth, and will cut 14-gage mild steel. This shear is 10 inches high, 23 1/2 inches long, and 16 inches wide, including the 1/4-H.P. motor with direct coupled drive. Distributed by the Federal Machinery Co., 134 Grand St., New York 13, N. Y. 103



To obtain additional information on equipment described on this page, see lower part of page 238.

EX-CELL-O

Can give you more economical production



Special Machine with Trunnion Fixture Combines Operations on Axle Housings

Combining operations is a time-proven method of obtaining more economical production. Shown here is an Ex-Cell-O special machine with a six-station power indexing trunnion type fixture that performs roughing and finishing operations on steel axle housings. Standard hydraulically-actuated slides at both ends of the machine carry multiple spindle heads and their drive motors. Another slide at the rear supports a precision spindle and a facing head.

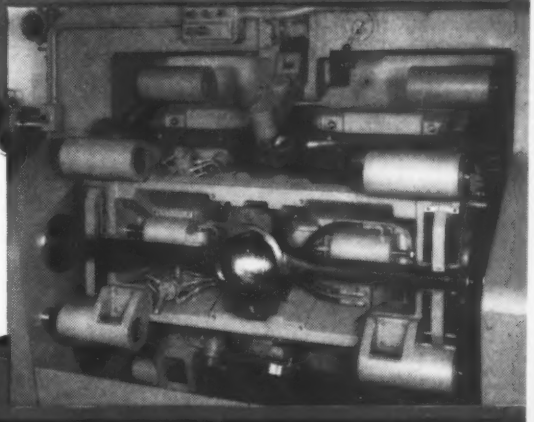
The tool holders in both the multiple spindle heads are rigidly guided by bushings in the fixture end frames. Coolant is manifolded to each station and directed through drilled holes to the point of contact between the tools and the work.

Parts are laid in the loading station and are located and clamped hydraulically. Operations are rough, semi-finish bore and ream bearing diameters at both ends; rough and finish face flanges, chamfer inside and outside edges of flanges and turn O.D. of flanges at both ends; face banjo. All these operations are performed at a net production rate of 55 pieces per hour!

Let Ex-Cell-O help you combine operations for more economical production. A complete staff of experienced machine tool engineers is ready to help you with your production problems. Contact your Ex-Cell-O representative today!

Above: Ex-Cell-O special machine performs many operations on steel rear axle housings.

Below: Close-up view of the Ex-Cell-O six-station trunnion type fixture which easily handles the large parts.



XLO

EX-CELL-O for PRECISION

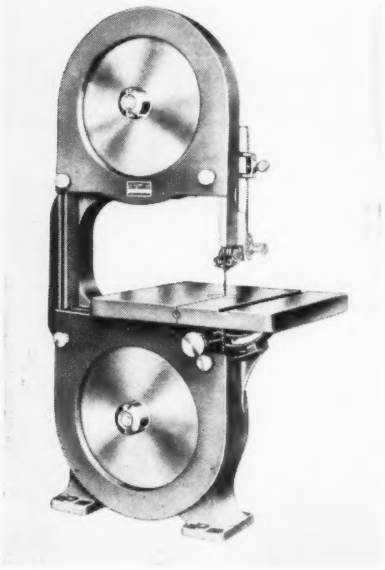
EX-CELL-O CORPORATION

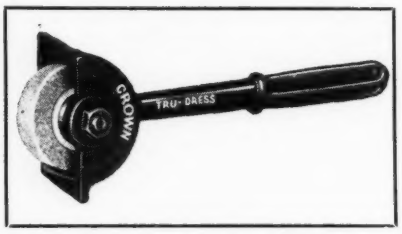
Detroit 32, Michigan

Special Multiple Way-Type Precision Boring Machines • Special Multiple Precision Drilling Machines • Precision Boring, Turning, and Facing Machines and Fixtures • Precision Cylinder Boring Machines • Precision Thread Grinding Machines • Precision Lapping Machines • Precision Broach Sharpening Machines • Other Special Purpose Machines • Tool Grinders • Continental Cutting Tools • Broaches and Broach Fixtures • Counterbore Sets • Grinding Spindles • Hydraulic Power Units • Drill Jig Bushings • R.R. Pins and Bushings • Fuel Injection Equipment • Dairy Equipment • Aircraft and Miscellaneous Production Parts

Foster Band Saw with Tilting Table

Band saw with wood- and plastic-cutting saw blade. Equipped with 12-inch sealed-for-life ball-bearing wheels having oil- and wear-resistant rubber tires. This unit is 33 1/2 inches high and has a table that tilts 50 degrees. Developed by Foster Mfg. Co., 1 Kinsey Ave., Buffalo 17, N. Y. 104





Grinding-Wheel Dresser

"Tru-Dress" grinding-wheel dresser designed to remove irregularities in the wheel and improve the cutting action. Emery wheel in the dresser turns fully on its bearings, insuring accurate balancing of the wheel being dressed. The dresser can also be used to shape wheels for grinding special contours. Available in two sizes, one with 3-inch diameter emery wheel and the other with a 4-inch wheel. Announced by Crown Industries, 1502 E. 53rd St., Chicago 15, Ill. 105

Swanson Thread Comparator

Comparator designed to show at a glance whether thread being checked is over size, under size, eccentric, tapered, or has a lead error. The indicator records sizes visually to accepted ring-gage tolerances, eliminating the element of human error. The gage anvils are made of high-quality gage steel, fully heat-treated. They are ground and lapped to Class 4 specifications of Screw Commission Standards. Component parts are of cast iron, reinforced at points of contact with precision-ground steel parts, hardened and lapped. Manufactured by the National Automatic Products Co., 23 Whiting St., New Britain, Conn. 106

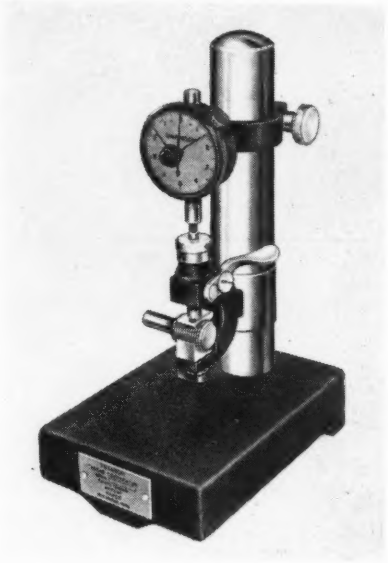
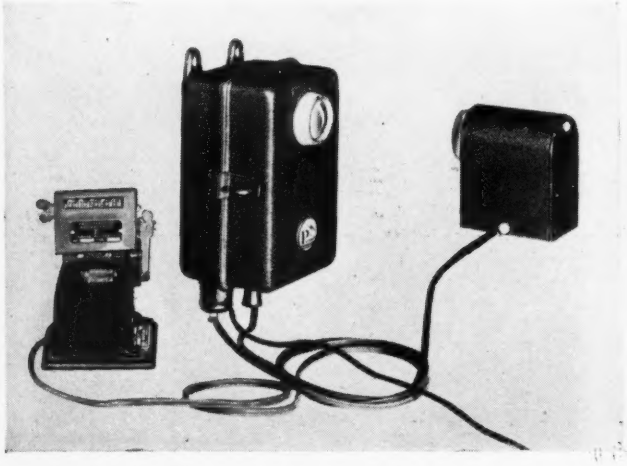


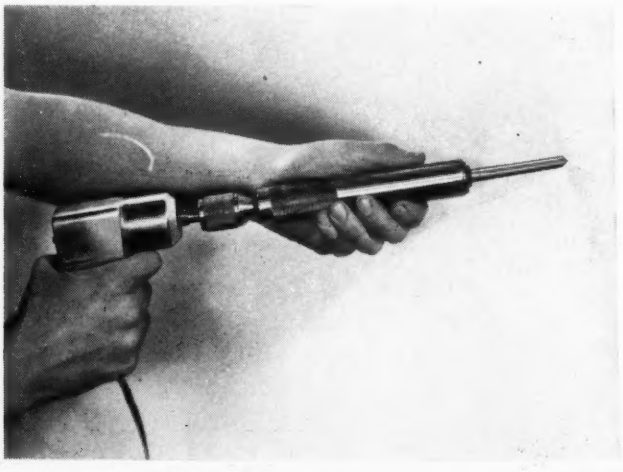
Photo-Electric Counter

General-purpose photo-electric counter made by Photoswitch, Inc., 77 Broadway, Cambridge 42, Mass., for installation on any conveyor system or automatic machine. This unit is designed for counting various sizes and kinds of articles. The light source supply has an adjustable-lens system which permits narrowing down the light beam for counting very small objects. The counter plugs into a 115-volt, 60-cycle, alternating-current outlet, and can make up to 600 counts per minute. The maximum number of counts before returning the counter to zero is 99,999. The counter can be reset to zero by simply turning a knob. 107

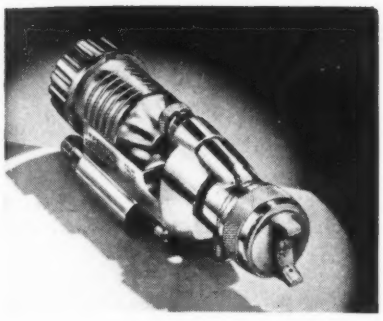
Hammer Attachment for Portable Drills

Hand tool, known as the "Dril-Hamer," brought out by Dril-Hamer Mfg. Co., Inc., 82-27 Grenfell Ave., Kew Gardens, N. Y., for converting rotary motion on any 1/4-inch electric drill, drill press, or chuck-equipped flexible-shaft machine into a hammering action. It strikes a blow for each revolution of the driver. The blow is delivered to the drill bit by an inside hammer actuated by a spring, thus automatically providing a combination of hammering action and rotation. The 2-pound tool accommodates drill bits ranging from No. 6 through 5/8 inch diameter. Peening, riveting, boiler-scaling, paint-removing, and blank bits are also available. 108





To obtain additional information on equipment described on this page, see lower part of page 238.

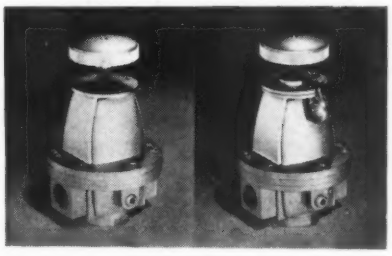


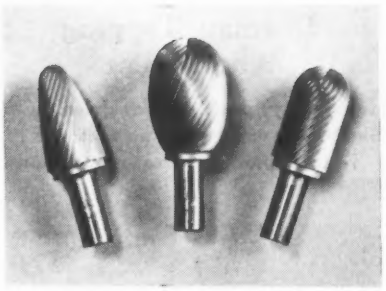
De Vilbiss Air-Piston Controlled Automatic Spray Gun

Improved automatic spray gun adaptable to any type of spray finishing machine. Controlled entirely by an air-operated piston, it opens, sprays, and closes 5400 times per hour. The gun is 7 inches long and weighs 2 3/4 pounds. It can be supplied with mounting adapters that provide flexibility for positioning at any angle required to direct the spray so that the work will be properly coated. Made by De Vilbiss Co., 300 Phillips Ave., Toledo 1, Ohio. 109

Hannifin Air-Pressure Regulators

Two new air-pressure regulators for specific uses on compressed-air lines, announced by the Hannifin Corporation, 1101 S. Kilbourn Ave., Chicago 24, Ill. Regulator at left is intended for panel or instrument-board installation, and one at right has locking device designed to prevent unauthorized change of pressure setting. 111





Severance Large-Size Carbide "Midget" Mills

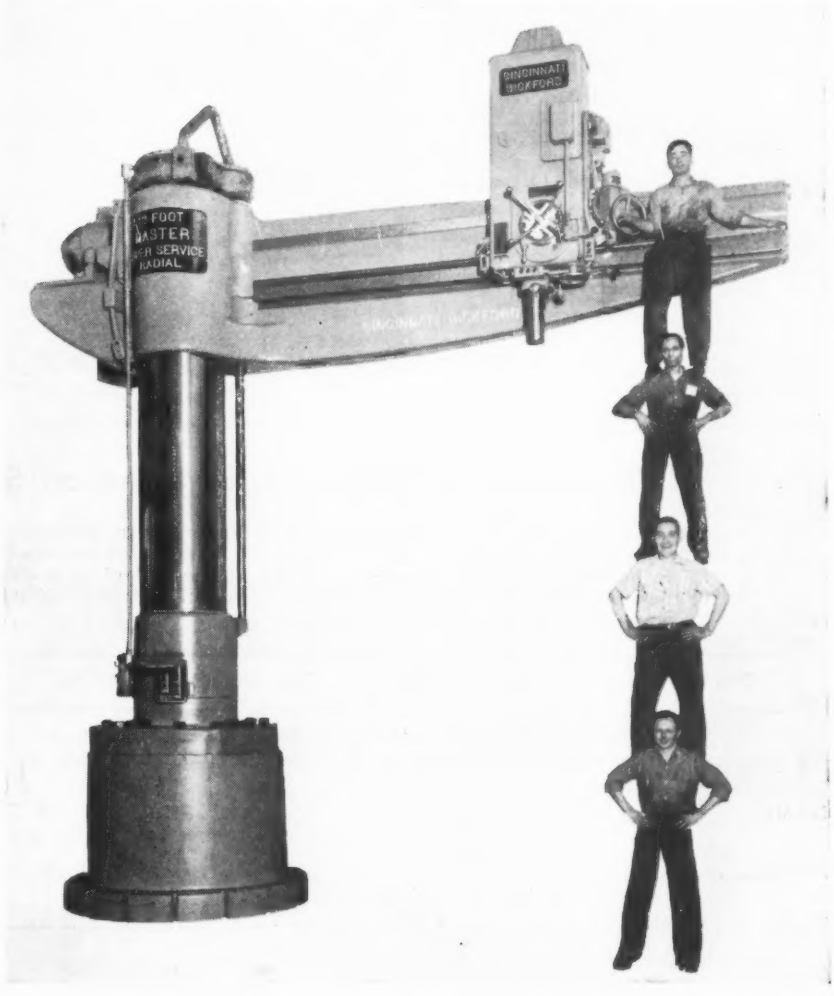
Three new carbide "Midget" mills, each the largest of its respective shape, recently added to the line made by Severance Tool Industries, Inc., 636 Iowa St., Saginaw, Mich. These mills are designed for operation at speeds of 2000 to 5000 surface feet per minute. 112

Master "Super Service" Radial Drill

Master "Super Service" 12-foot radial drill developed by the Cincinnati Bickford Tool Co., Oakley, Cincinnati 9, Ohio. The over-all height of this machine is 22 feet, and the maximum clearance from the floor to the spindle on the drilling head is 14 1/4 feet. 113

Vest-Pocket Dial Indicator

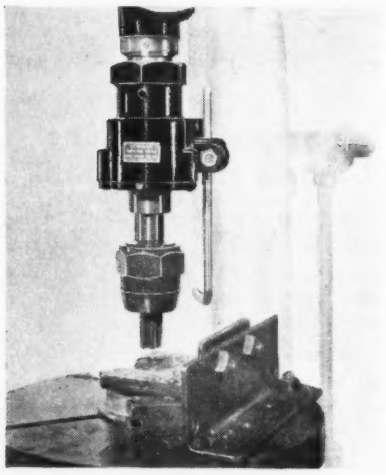
Dial indicator no larger than a thin pocket watch, manufactured by the L. S. Starrett Co., Athol, Mass., to provide a handy means for measuring and comparing the thicknesses of sheet metal, wire, plastics, paper, leather, rubber, and similar materials. It is graduated to read in thousandths of an inch. A small "telltale" hand counts the revolutions of the larger hand up to the maximum range of 3/8 inch. The spindle is raised by sliding back a serrated plate at the top edge of the gage. 110



To obtain additional information on equipment described on this page, see lower part of page 238.

Dorman Tapping Attachment

Heavy-duty, positive gear-drive, automatic-reverse tapping attachment for 3/4- to 2-inch pipe taps and standard hand or machine screw taps. Brought out by Dorman Machine Tool Works, 38 S. MacQuesten Parkway, Mount Vernon, N. Y., for use in back-geared drill presses. Collet type tap-holder holds the tap by the round section and drives it by the square section. 114

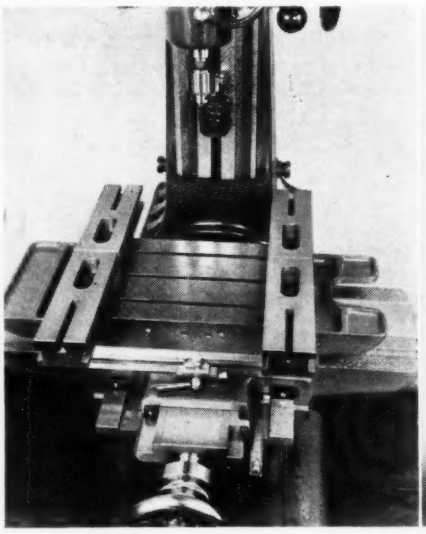


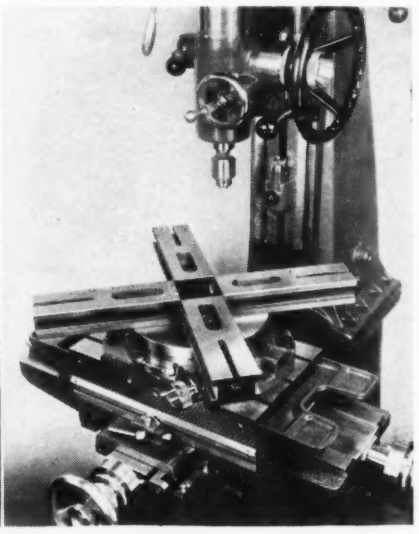
Blind-Hole Broaches

Rotary broach designed to replace reamers and to eliminate a second broaching operation. Will produce fine finish to the bottom of a drilled hole, holding the size within limits of 0.0001 inch. Can be used in lathes, turret lathes, automatics, boring mills, milling machines, jig borers, and similar machines. The right-hand helical cutting flutes of these broaches cause the chips to be fed out of the hole, thus making it possible to feed the rotary broach to the bottom of a blind hole. Stock sizes start at 3/16 inch and are increased, by 1/32-inch steps, to 1 inch in diameter; 1- to 1 1/2-inch stock sizes increase by increments of 1/16 inch. Placed on the market by Shearcut Tool Co., Box 746, Reseda, Calif. 115

Extension Parallels Designed to Increase Work-Holding Capacity of Moore Jig Borers

Extension parallels brought out by the Moore Special Tool Co., Inc., 734 Union Ave., Bridgeport 7, Conn., are made in sets of four for use on the jig borers and jig grinders built by this concern to increase the capacities of the regular tables. When used on the table of a jig borer, as shown in the view at left, work 5 inches larger than the regular table size in both directions, or 10 inches in only one direction, can be accommodated. Rings more than 20 inches in diameter can be accommodated on 10-inch circular tables when the extensions are applied as shown in the view at right. The parallels are 2 inches thick, 3 inches wide, and 10 inches long. T-slots are provided for clamping the work in place. 116





To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description — or write directly to the manufacturer, mentioning machine as described in October, 1948, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME.....**POSITION OR TITLE**.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

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CITY.....**STATE**.....

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 244 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the October, 1948, Number of MACHINERY

Pneumatic Die-Cushion Manual

DAYTON ROGERS MFG. CO., 2824 Thirteenth Ave., S., Minneapolis 7, Minn. Booklet entitled "Installation Instructions and Parts Manual for Pneumatic Die Cushions," devoted to the installation and operation of the company's line of pneumatic die cushions. Much of the information given is basic, applicable to all types of pneumatic die cushions. 1

Die Manual

VERSON ALLSTEEL PRESS CO., 9309 S. Kenwood Ave., Chicago 19, Ill. Handbook containing 88 pages of engineering data relating to press-brake dies, punching attachments, and press brakes. Over 200 press brake dies are illustrated and described, and specifications covering Verson press brakes are included. 2

Automatic Position-Adjusting Control

LEEDS & NORTHRUP CO., 4934 Stenton Ave., Philadelphia 44, Pa. Catalogue ND4A(1), containing 40 pages of data on the L&N position-adjusting type electric control, applicable to any process that can be controlled by moving a valve, vane, or damper. 3

Dies, Molds, and Tools for Die-Casting

DIE-MOLD CORPORATION, 6619 Motor Ave., Milwaukee 13, Wis. Series of leaflets showing typical parts made from dies, molds, and tools produced by the company for the die-casting, permanent-mold casting, and plastic industries. 4

Cylindrical Grinders

LANDIS TOOL CO., 12 E. Sixth St., Waynesboro, Pa. Catalogue containing 28 pages of data on Landis standard and special-purpose cylindrical grinders. Design features are explained by diagrams, and machine applications are illustrated by operation sketches. 5

Hydraulic Presses

BALDWIN LOCOMOTIVE WORKS, Eddystone, Pa. Bulletin 285, illustrating and describing the Southwark line of hydraulic presses, ranging in capacity from 100 to 6000 tons, for the high-speed production and accurate forming of sheet-metal parts to any desired shape. 6

Free-Cutting Machinery Steel

JOSEPH T. RYERSON & SON, INC., Box 8000-A, Chicago 80, Ill. Illustrated bulletin describing "Rytense" AA medium-carbon, high-strength, free-cutting machinery steel, which is supplied in hot-rolled and cold-finished bar form, as well as in forged bar form. 7

Solder Tin-Content Indicator

WHEELCO INSTRUMENTS CO., 847 W. Harrison St., Chicago 7, Ill. Bulletin D700-1, descriptive of a solder tin-content indicator for quick analysis of solder quality. Educational Bulletin 8, containing technical data on the operation of the indicator. 8

Automatic Collets

BALAS COLLET MFG. CO., Department D, 3800 Woodland Ave., Cleveland 15, Ohio. Catalogue 48, containing complete information on the company's line of automatic collets, pushers and pads, turret lathe collets and pads, and lathe and milling machine collets, including list prices. 9

Cold-Finished Bar Steel

REPUBLIC STEEL CORPORATION, Cleveland 1, Ohio. Booklet entitled "Quick Facts About Republic Union Cold-Drawn Steels," describing uses and mechanical properties of the types most frequently used. Size and tolerance data are included. 10

Hard-Facing Alloys

AIR REDUCTION SALES CO., Department 1968, 60 E. 42nd St., New York 17, N. Y. Booklet covering the complete new line of Airco hard-facing alloys. Data on typical uses, specifications, and application technique are included. 11

Speed Reducers and Sprockets

CULLMAN WHEEL CO., 1344-54 Altgeld St., Chicago 14, Ill. Booklet containing engineering information on single- and double-reduction type speed reducers. Circular giving data on the company's line of over 700,000 stock sprockets. 12

Variable-Speed Motors

U. S. ELECTRICAL MOTORS, INC., 200 E. Slauson Ave., Los Angeles 54, Calif. Bulletin descriptive of the new Model US Varidrive motors which enable a machine operator to obtain infinite speeds. Operating principles and applications are described. 13

How to Build Stronger, Lighter Levers at Less Cost

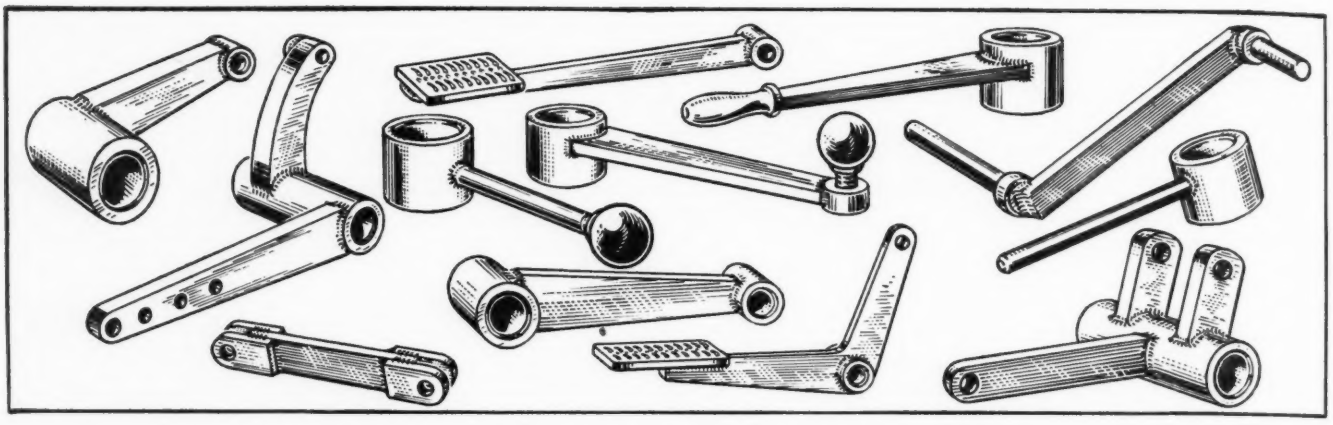

Fig. 1. Typical machinery operating levers that are being weld-fabricated at lower cost with arc welding.

ALL types of levers are being weld-fabricated in shops throughout the country, helping to produce stronger, lighter machinery construction with improved appearance . . . *all at less cost than with other methods.* Here is how these levers are built:

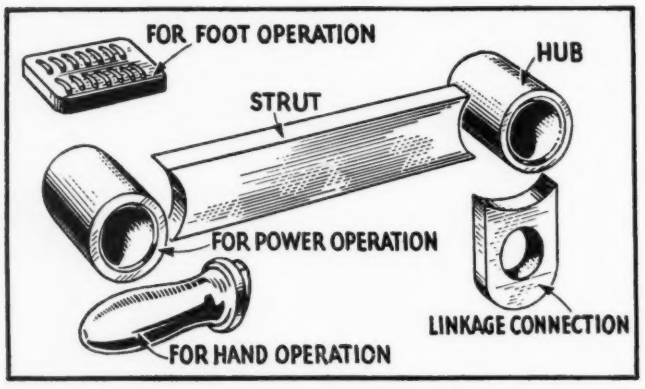

Fig. 2. Basic elements of levers for different types of operation.

More detailed data on the design of levers for arc welding is contained in the "Procedure Handbook of Arc Welding Design and Practice." Price $1.50 postpaid in the U. S. A.; elsewhere $2.00.

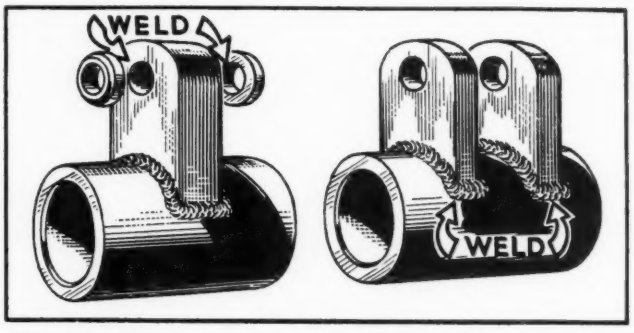

Fig. 3. Linkage connections for power take-off, made from steel straps.

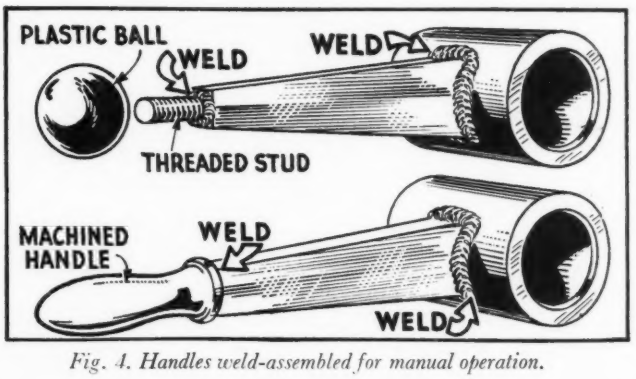

Fig. 4. Handles weld-assembled for manual operation.

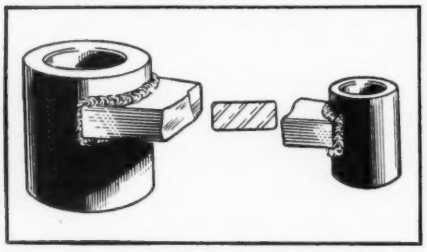

Fig. 5. Plain rectangular strut welded to hubs. For normal loads.

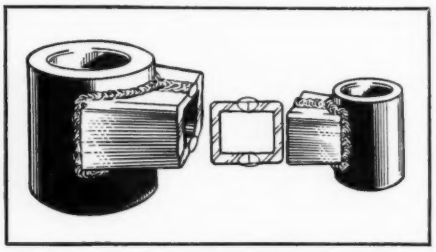

Fig. 6. "Box" section design strut for strong, light-weight construction.

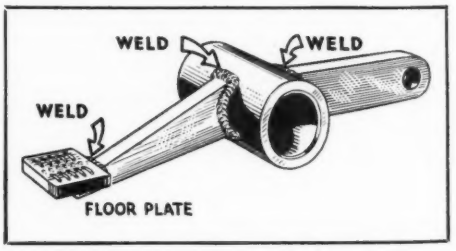

Fig. 7. Floor plate weld-attached for foot operation.

The above is published by LINCOLN ELECTRIC in the interests of progress. Machine Design Studies are available to engineers and designers. Write on your letterhead to The Lincoln Electric Company, Dept. 410, Cleveland 1, Ohio. **Advertisement**

Molded and Laminated Plastics

GENERAL ELECTRIC CO., Chemical Department, Pittsfield, Mass. Bulletin CDP-578, describing G-E molded and laminated plastics and molding service. Tables of general properties of the various plastics are included. 14

Polishing and Grinding Machines

HAUSER MACHINE TOOL CORPORATION, 74 Bournedale Road North, Manhasset, N. Y. Circular illustrating and describing Swiss type pivot polishing machines for the instrument and watch trades. 15

Die-Castings

LOS ANGELES DIE CASTING CO., 340 Crocker St., Los Angeles 13, Calif. Bulletin entitled "Improve Your Products," describing the many possibilities of the die-casting process in reducing production costs and improving products. 16

Precision Second-Operation Machines

HARDINGE BROTHERS, INC., Elmira, N. Y. Bulletin DSM 59, outlining the special features of Hardinge high-speed precision second-operation machines. Complete specifications for these machines are included. 17

Gear Testers

GEORGE SCHERR CO., INC., 199 Lafayette St., New York 12, N. Y. Folder describing the various models of Parkson gear testers, which are made in sizes from 4 1/2 to 36 inches capacity.....18

Decimal-Fraction Calculator

WENDT-SONIS CO., Hannibal, Mo., is distributing without charge a new decimal-fraction calculator designed for use in adding and subtracting fractions and converting fractions to decimals or vice versa. 19

Clutches

MORSE CHAIN CO., Department 22, 7601 Central Ave., Detroit 8, Mich. Catalogue C11-48, devoted to the construction, development, and working principles of the new Morse-Formsprag over-running clutch. 20

Mounted Points and Wheels

A. P. DE SANNO & SON, INC., Phoenixville, Pa. Catalogue 104, containing information on the various shapes and dimensions of Radiac mounted points and wheels for grinding or polishing any material. 21

Self-Lubricating Bushings

GRAPHITE METALLIZING CORPORATION, 1050 Nepperhan Ave., Yonkers 3, N. Y. Pamphlet entitled "The Story of Self-Lubricating Bushings," describing the advantages of Graphalloy babbitt and copper bushings. 22

Wheel-Tread Grinder Operating Manual

AMERICAN CAR AND FOUNDRY COMPANY, 30 Church St., New York 8, N. Y. Manual containing complete instructions for operating ACF high-speed wheel-tread grinders. 23

Grinding Wheels

STERLING GRINDING WHEEL DIVISION, CLEVELAND QUARRIES CO., Tiffin, Ohio. Folder containing specifications on Sterling grinding wheels for cutting-off, snagging, and portable grinding operations. 24

Hydraulic Valves

R. D. WOOD CO., Public Ledger Bldg., Philadelphia 5, Pa. Bulletin illustrating typical examples of the line of standard and special hydraulic valves produced by this company for a wide variety of uses. 25

Controlled Lubrication

ALEMITE DIVISION, STEWART-WARNER CORPORATION, 1826 Diversey Parkway, Chicago 14, Ill. Catalogue illustrating and describing the Alemite systems of centralized lubrication. 26

Timing, Control and Recording Instruments

GORRELL & GORRELL, Haworth, N. J. Bulletin G-100. entitled "Many Speeds for Many Needs," describing the line of timing, control, and graphic recording instruments made by the company.....27

High-Precision Equipment

HIGH PRECISION PRODUCTS CO., Westfield, N. J. Circular illustrating examples of the precision equipment handled by the company, including optical hardness testers, measuring microscopes, jig boring machines, etc. 28

Thread Milling Machines

EDWARD BLAKE CO., 437 Cherry St., West Newton 65, Mass. Bulletin 248, describing the improved design features of the Waltham line of thread milling machines, for which this company is the distributor. 29

Induction Motors

ALLIS-CHALMERS MFG. CO., Milwaukee 1, Wis. Bulletin containing engineering data on Allis-Chalmers large induction motors of the squirrel-cage, wound-rotor, bracket-bearing, and pedestal-bearing types. 30

Hard-Surfacing Electrodes

PAGE STEEL & WIRE DIVISION, AMERICAN CHAIN & CABLE CO., INC., Monessen, Pa. Booklet DH 45, covering manganese-nickel, shielded-arc electrodes and other electrodes applicable for hard-surfacing. 31

Engineering Service

SERVICE MACHINE CO., Elizabeth, N. J. Leaflet illustrating the machine tool facilities of the company available for producing special machines, as well as dies, jigs, fixtures, and assemblies, to specifications. 32

Angle Inspection

WEBBER GAGE CO., 12900 Triskett Road, Cleveland 11, Ohio. Circular containing information on the precision inspection of angles by the use of Webber angle gage-blocks. 33

Injection Molding Machines

HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio. Bulletin 4802, describing plastics injection molding machines of the hydraulic, self-contained type, and the method of operation. 34

Pneumatic Kits

NATIONAL PNEUMATIC CO., Rahway, N. J. Folder 1066, describing the company's line of pneumatic "packaged" kits for converting light production machinery to air-power operation. 35

Electric Motor Drives

LIMA ELECTRIC MOTOR CO., Department CL, Lima, Ohio. Bulletin MB-1, on the Lima line of electric motors, multi-speed gear-shift drives, motor-driven grinders, and polishing and buffing lathes. 36

Fastening Devices

SIMMONS FASTENER CORPORATION, 1750 N. Broadway, Albany 1, N. Y. Bulletin illustrating some of the many applications of the Simmons line of quick-lock, spring-lock and lock-nut fasteners. 37

Precision Castings

AUSTENAL LABORATORIES, INC., 715 E. 69th Place, Chicago 37, Ill. Booklet entitled "New Horizons with Microcasting," showing many interesting examples of precision castings produced by the Microcast process. 38

Contour Forming

CYRIL BATH CO., 6955 Machinery Ave., Cleveland 3, Ohio. Catalogue describing the contour forming of difficult curved metal parts in lots from 100 to 100,000 pieces. 39

Abrasive Belts

BEHR-MANNING, DIVISION OF NORTON CO., Troy, N. Y. Circular descriptive of the new Resinall Metalite abrasive belt, designed for all dry grinding operations involving heat. 40

Arc-Welding Electrodes

WILSON WELDER & METALS CO., INC., 60 E. 42nd St., New York 17, N. Y. Catalogue containing 40 pages of data on Wilson arc-welding electrodes, including an electrode selector chart. 41

Heat-Treating Furnaces

SURFACE COMBUSTION CORPORATION, Toledo 1, Ohio. Bulletin SC-138, on controlled-atmosphere hardening furnaces, which are also adapted for carburizing, annealing, etc. 42

Power Belt Conveyors

RAPIDS - STANDARD CO., INC. (Department SB-169), 342 Rapistan Bldg., Grand Rapids 2, Mich. Bulletin SJA-N48, describing and illustrating the Stevedore, Jr., power belt conveyor. 43

Mercury Clutches

AUTOMATIC STEEL PRODUCTS, INC., Canton 6, Ohio. Bulletin 173, describing the Mercury clutch, with automatic torque control, for gasoline engines and electric motors. 44

Clutches

TWIN DISC CLUTCH CO., Racine, Wis. Thirtieth anniversary issue of "Production Road," containing a survey of power and its transmission through the years. 45

Zinc Die-Castings

GRIES REPRODUCER CORPORATION, 780 E. 133rd St., New York 54, N. Y. Circular covering the GRC process of producing small zinc die-castings on an economical basis. 46

Copper-Base Alloys

FANSTEEL METALLURGICAL CORPORATION, North Chicago, Ill. Five technical data bulletins descriptive of five copper-base alloys for electrical and mechanical applications. 47

Form-Dressing Equipment

J & S TOOL CO., INC., East Orange, N. J. Booklet illustrating and describing in detail "Fluid-motion" radii and angle dressers for form-dressing of grinding wheels. 48

Electronic Testing Machine

TINIUS OLSEN TESTING MACHINE CO., 1052 Easton Road, Willow Grove, Pa. Bulletin 37, descriptive of a new electronic "Electromatic" universal testing machine. 49

Socket Screws

BRISTOL CO., Waterbury 91, Conn. Catalogue 854, containing 36 pages of data on hexagon and multiple-spline socket-screws, cap-screws, stripper bolts, etc. 50

Machine-Molded Pulleys

PYOTT FOUNDRY & MACHINE CO., 328 N. Sangamon St., Chicago 7, Ill. Catalogue 60, covering the company's line of machine-molded cast-iron pulleys. 51

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (October, 1948) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

NAME.....**POSITION OR TITLE**.....

[This service is for those in charge of shop and engineering work in manufacturing plants]

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CITY.....**STATE**.....

By E.S.S.

BETWEEN GRINDS

Glad! Glad! to Be of Service

A Canadian began a letter asking us for information with a well-turned and punctuated compliment: "I have always bought books from your firm and I can say that they have been very! very! useful."

Hypothetically Speaking

As though there weren't enough existing problems today, here we go cooking up one just for your pleasure, and if you are the type who can't resist guessing the number of beans in a window, you will fall in and at least guess at the answer. If you are a whiz, you can work this out by means of a geometric theorem (this is a clue, Ed.): Just suppose a railroad company laid a welded steel track for a distance of one mile with the earth graded so that the track was absolutely straight. At both ends the track was bolted securely so that there could be no endwise movement. On a very hot day not so long ago (story-telling instinct coming to light), the track expanded one foot in length. However, it chose to expand only at one point, and that in the middle and in an upward direction exclusively. How much did it rise? Feet, inches, or fraction of an inch, and how many of the same? Personally, we are still working on the high school problem of the rowboat going up and down the river with and without the current, so we had our math. expert put the solution on paper, which will be presented one month hence—same page same announcer (we hope).

Ecstatic Astatic

This little poem announcing "We Have Moved" out-Edgars guess who:

The Astatic Corporation used
to be where they ain't no
more,
They've moved where they
never was before,
You know where they was, but
not where they is,
So here's the new number as
follows and viz:
Conneaut, Ohio
Harbor and Jackson Streets

Our Italian Cousin

Mr. Amino Pancrazi of Florence, Italy, has conferred upon us the distinction of periodical patriarchy, ending a letter to us "Happy to be in your big family of MACHINERY subscribers."

Magnesium Tailor-Made

The medieval knight traipsed around in an iron suit weighing approximately 150 pounds. But Hollywood, in filming "Joan of Lorraine," has designed a magnesium suit weighing only 18 pounds. The armor, consisting of 169 individual parts, was made on an assembly line by the Arrowsmith Tool & Die Co. of Los Angeles. We can hear celestial rumblings of ye olde knights: "Odzooks, what manner of material is this magnesium?"

Your Letter is With Us

The receipt of one of our books was acknowledged by a resident of Kanpur, India, thusly: "Dear Sir: The 'Die-Casting' by Mr. Charles O. Herb published by you is with me."

Full-Steam-Ahead ROBERT MAWSON—Opening his eyes on the heaths of Yorkshire, England (bound to be a heath there), contributor Robert Mawson learned his mechanical engineering in Bradford (Bradford Technical College and Bradford Mechanics Institute, Bradford, Yorkshire, to be exact, and probably on more heaths, to be inexact). Set sail for these United States and then ran all the way up the ladder from machinist and toolmaker to some pretty special perches as industrial engineer with the George S. May Co. Chicago, Ill. (ten years with May);

factory manager with the Trane Co., La Crosse, Wis.; and industrial specialist on the War Production Board for three years during the recent war. Now as a registered professional engineer he holds forth on Stewart St. in Providence, R. I., dipping into his barrel of experience to solve engineering problems and occasionally to send short articles about them to MACHINERY (as you may see by turning to page 195). Mr. Mawson has a hobby of collecting old and rare coins. He didn't tell us, but we know that makes him a numismatist.

News of the Industry

California and Washington

J. H. WILLIAMS & Co., Buffalo, N. Y., manufacturers of drop-forgings and drop-forged tools, announce the opening of a warehouse and sales office in Los Angeles, Calif., at 2266 E. 38th St. (Vernon). A complete stock of all Williams products will be carried at the new warehouse to serve the western area. CHARLES F. COATES has been appointed western district manager in charge of the new sales office and warehouse.

C. M. KEMP MFG. CO., Baltimore, Md., manufacturer of precision carburetors, industrial burners, gas generators, and dryer systems, announces the retirement of E. B. PARSONS as its San Francisco area representative. Mr. Parsons will be succeeded by the E. A. WILCOX Co., 277 Seventh St., San Francisco, Calif., with a branch office in Seattle.

A. W. NASH Co., 5225 Wilshire Blvd., Los Angeles 36, Calif., has been appointed Southern California representative of the AJAX FLEXIBLE COUPLING Co., INC., Westfield, N. Y. The A. W. Nash Co. is taking over the agency from HOWARD SPEDDY, who is retiring from business.

J. A. GREENLAND has been appointed district manager of the Seattle, Wash., office of the DeLaval Steam Turbine Co., Trenton, N. J. He has been connected with that office for eight years.

Illinois and Missouri

FANSTEEL METALLURGICAL CORPORATION, North Chicago, Ill., announces that it has acquired the entire common stock equity in the VASCOLOY-RAMET CORPORATION held by the VANADIUM-ALLOYS STEEL Co., Latrobe, Pa. The Vascoloy-Ramet Corporation, located in Waukegan, Ill., will continue to be operated under its own name as a division of the Fansteel Metallurgical Corporation.

H. B. SEARS has been appointed mill supply products salesman in the Indianapolis, Ind., area for the Bristol Co., Waterbury 91, Conn. He has just completed a year and a half of training in the main office and factory of the company at Waterbury. Mr. Sears' headquarters will be at the Chicago branch office of the company, located at 351-363 E. Ohio St.

ARTHUR E. KIMBALL, Chicago zone sales manager for the Minnesota Mining & Mfg. Co., St. Paul, Minn., has been promoted to the position of manager of development and sales for heavy grinding products in the Coated Abrasives Division of the company. His headquarters will be in Chicago, Ill.

WALTER W. KEMPHERT has been elected vice-president in charge of sales of Skilsaw, Inc., Chicago, Ill., manufacturer of portable electric tools. He had been previously associated for twenty years with the Worthington Pump & Machinery Corporation, Harrison, N. J.

E. W. CHAPMAN has been appointed vice-president in charge of engineering of the Tuthill Pump Co., Chicago, Ill. He previously served in a similar capacity for Bowser, Inc., Industrial Pump Division at Fort Wayne, Ind.

MAJOR GENERAL JOSEPH A. TEECE has been elected vice-president of the Fansteel Metallurgical Corporation, North Chicago, Ill. He was previously assistant to the president.

ERCELL R. STEVENS has recently been appointed abrasive grain engineer in the Chicago district for the Norton Co., Worcester, Mass.

LINDBERG STEEL TREATING Co. announces the construction of a new custom heat-treating plant at 650 E. Taylor Ave., St. Louis, Mo. The new plant will have 6000 square feet of floor space and will house fourteen new heat-treating furnaces.

Michigan

ELWYN KAAKE has been made chief engineer in charge of engineering and production for the Neptune-Power Plus Products Co., Detroit, Mich., manufacturer of hydraulic power units, air- and oil-operated cylinders, pumps, etc. CHARLES BILLADEAU is in charge of production of the Electrical Division, THOMAS JONES of the Armature Wedge Division, and PHILIPP BROD of the Plating Division.

P. J. JENSEN, formerly executive engineer in the Engineering and Research Department of the Carboloy Company, Inc., Detroit, Mich., has been made manager of the Michigan district, with headquarters in Detroit. Mr. Jensen succeeds M. E. KNOLL, who has been manager of the Michigan district for eighteen years.

HENRY M. HARROLD has been made vice-president of operations of Bridgman Castings, Inc., Bridgman, Mich., a subsidiary of the Hannifin Corporation, Chicago, Ill. Mr. Harrold joined the Bridgman organization as sales manager early this year, having previously been associated with the Sperry Gyroscope Co.

SAMUEL J. MATCHETT has recently been appointed manager of the Detroit office of Pratt & Whitney, Division Niles-Bement-Pond Co., at 2836 E. Grand Boulevard. He had been connected since 1923 with the Chicago office. Mr. Matchett succeeds the late H. William Kopf, who had been Pratt & Whitney Detroit manager since 1915.

W. F. ARMSTRONG has been made general manager of the Chevrolet Motor Division, General Motors Corporation, Detroit, Mich., succeeding the late Nicholas Dreystadt.

ROBERT O. BLACKFORD has been named advertising and sales promotion manager of the Michigan Abrasive Co., Detroit, Mich.

New England

DAVID A. UTIGER has been made sales manager of the Saw Division of the Howes-Woods Co., Cambridge, Mass., manufacturer of metal-cutting hacksaw blades and accessories. For the last eight years Mr. Utiger has been manager of the Industrial Division of the Capewell Mfg. Co., Hartford, Conn.

W. V. GARFIELD has been appointed district sales engineer in the territory of Connecticut and western Massachusetts for the Butterfield Division of the Union Twist Drill Co., Derby Line, Vt. His headquarters are at 105 Grove St., Naugatuck, Conn.

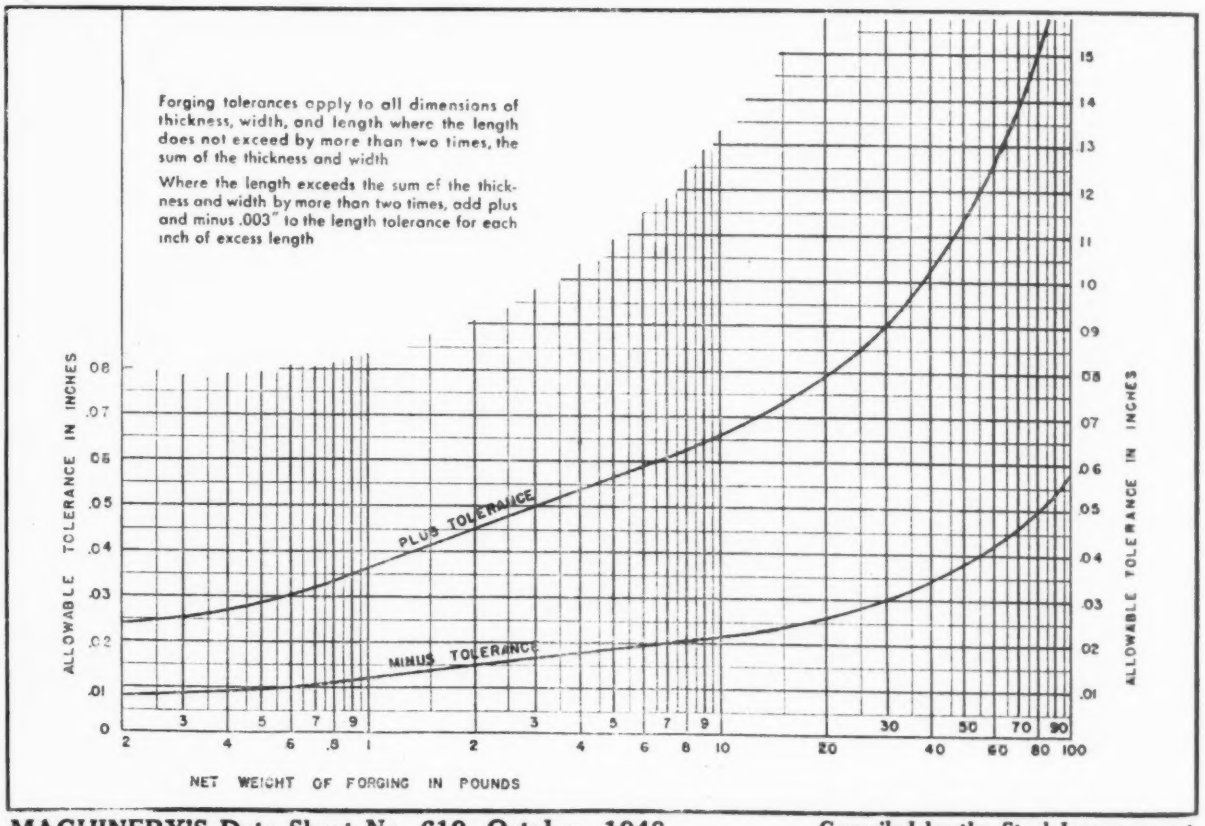
ADELSON-WIRTS, INC., 1800 Park St., Hartford, Conn., has been appointed a dealer for the products of the Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y., which include welding and cutting gases, apparatus and supplies, arc-welders, and carbide.

CARL F. TER WEELE has been appointed export manager for the Farrel-Birmingham Co., Inc., Ansonia, Conn.

LESTER G. SIGOURNEY, general sales manager of the New Departure Division, General Motors Corporation, Bristol, Conn., has retired after forty years of association with the company. FRANK J. MILLER succeeds Mr.

MACHINERY'S DATA SHEETS 619 and 620

TOLERANCES FOR IMPRESSION DIE FORGINGS


Forging tolerances apply to all dimensions of thickness, width, and length where the length does not exceed by more than two times, the sum of the thickness and width
Where the length exceeds the sum of the thickness and width by more than two times, add plus and minus .003" to the length tolerance for each inch of excess length
PLUS TOLERANCE
MINUS TOLERANCE
ALLOWABLE TOLERANCE IN INCHES
ALLOWABLE TOLERANCE IN INCHES
NET WEIGHT OF FORGING IN POUNDS

MACHINERY'S Data Sheet No. 619, October, 1948

Compiled by the Steel Improvement and Forge Co., Cleveland, Ohio

COMMERCIAL TOLERANCES FOR MAGNESIUM-ALLOY SHEET AND EXTRUSIONS

SHEET

Dimension		Thickness, Inches	Tolerance + or — (Inches)
Thickness	Up to 36 Inches Wide	0.015-0.036 0.037-0.050 0.051-0.080 0.081-0.250	0.002 0.0025 0.003 5% of sheet thickness
	36 Inches Wide and Over	0.015-0.036 0.037-0.050 0.051-0.080 0.081-0.250	0.0025 0.003 0.004 5% of sheet thickness
Width	Up to 18 Inches Wide	0.015-0.102 0.103-0.250	1/16 3/32
	Over 18 and up to 36 Inches Wide	0.015-0.102 0.103-0.250	3/32 1/8
	Over 36 Inches Wide	0.015-0.102 0.103-0.250	1/8 3/16
Length*	Up to 18 Inches Long	0.015-0.250	1/16
	Over 18 and up to 48 Inches	0.015-0.250	3/32
	Over 48 and up to 120 Inches	0.015-0.250	1/8
	Over 120 Inches Long	0.015-0.250	3/32

*On Exact Lengths the Tolerance is Plus 1/8 Inch, Minus 0.

EXTRUSIONS

Cross-Sectional Dimensions

Diameter or Distance across Flats, Inches	Tolerance, + or — (Inches)		
	Round, Square, Hexagonal, and Rectangular Bars	Structural Shapes	Tubing
Through 0.125	0.007	0.010	.....
0.126- 0.500	0.007	0.015	0.008
0.501- 1.000	0.010	0.020	0.010
1.001- 2.000	0.012	0.025	0.015
2.001- 3.000	0.015	0.030	0.018
3.001- 4.000	0.018	0.035	0.023
4.001- 5.000	0.020	0.040	0.027
5.001- 6.000	0.022	0.045	0.031
6.001- 7.000	0.025	0.050	0.037
7.001- 8.000	0.030	0.055	.....
8.001- 9.000	0.035	0.060	.....
9.001-10.000	0.040	0.067	.....
10.001-11.000	0.045	0.070	.....
11.001-12.000	0.050	0.080	.....

Length

Length, Feet	Tolerance + or — (Inches)
Up to 12	Plus 1/8, Minus 0
12 and over	Plus 1/4, Minus 0

MACHINERY'S Data Sheet No. 620, October, 1948

Compiled by Brooks & Perkins, Inc. Detroit, Mich.

500 FORGINGS *Broached* PER HOUR

FIVE FACES—
on THREE SIDES
of the FORGING—ARE BROACHED

in one pass

Cleveland Hardware & Forging Co. broaches five faces on this gear shift lever forging in one pass with an hourly production of 500 pieces. To finish these same faces by previous methods took three operations. In addition, all surfaces are now suitable for final assembly as they come off the broaching machine. The tooling which allows the broaching of two pieces per pass was designed and built by Detroit Broach Co. for a hydraulic press.

This is typical of the savings to be had by applying broaching to your parts production. Whether an intricate contour or a simple notch to be produced, broaching offers greater production, less idle machine time, fine finishes and identical form and dimensions on each part produced.

Detroit Broach application engineers specialize in broaches and broach tooling exclusively. They are familiar with all types of broaching and all broaching machines. This specialized experience is at your disposal to help solve your broaching problem. Write today for our representative to come in for a discussion.

DETROIT *Broach* COMPANY

20201 SHERWOOD AVENUE
DETROIT 12, MICHIGAN

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© Fabian Bachrach

(Left) Lester G. Sigourney, who has Retired as General Sales Manager of New Departure Division, General Motors Corporation. (Right) Frank J. Miller, Newly Appointed General Sales Manager

Sigourney. Mr. Miller has had charge of the New Departure Chicago office for the last eleven years. WILLIAM T. MURDEN, assistant general sales manager for the last five years, has been transferred to Meriden, Conn., as resident manager of the company's plant in that city.

PRATT & WHITNEY DIVISION, NILES-BEMENT-POND CO., announces the following officers for the newly organized POTTER & JOHNSTON CO., Pawtucket, R. I., a wholly-owned subsidiary of the company: CLAYTON R. BURT, president; E. P. GILLANE, vice-president and controller; J. EARLE MAKANT, vice-president and factory manager; J. POTTER CUNNINGHAM, vice-president and sales manager; R. W. BANFIELD, secretary and treasurer; and CARL A. G. BIRKEDAL, assistant secretary-treasurer.

(Left) Clayton R. Burt, President of the Potter & Johnston Co.; (Right) E. P. Gillane, Vice-president and Controller; (Lower Left) J. Earle Makant, Vice-president and Factory Manager; (Center) J. Potter Cunningham, Vice-president and Sales Manager; (Lower Right) R. W. Banfield, Secretary and Treasurer

New York and New Jersey

PROFESSOR GREGORY J. COMSTOCK has been retained as consultant in the powder metallurgy field by the Lake Erie Engineering Corporation, Buffalo, N. Y., manufacturer of hydraulic presses and heavy special machines. Professor Comstock is director of the powder metallurgy laboratory of Stevens Institute of Technology, Hoboken, N. J. He will not only serve the Lake Erie Engineering Corporation in a consulting capacity, but will also carry on research work in powder metallurgy applied to hydraulic press design.

WILLIAM H. STARBUCK has been appointed assistant general sales man-

ager of the Kellogg Division of the American Brake Shoe Co., 230 Park Ave., New York 17, N. Y. He was formerly sales representative for the company. Mr. Starbuck will be located at the division's headquarters in Rochester, N. Y.

ELECTRO METALLURGICAL CO., UNIT OF UNION CARBIDE AND CARBON CORPORATION, 30 E. 42nd St., New York 17, N. Y., has been made plans for the erection of a new ferro-alloy plant near Marietta, Ohio. The plant will provide facilities for producing ferro-alloys of various types, used in the manufacture of steel and iron, including silicon alloys, manganese alloys, and chromium alloys.

VANDYKE CHURCHILL CO., 114 Liberty St., New York 6, N. Y., announces that it is now representing the DEFIANCE MACHINE WORKS, Defiance, Ohio (manufacturer of horizontal boring mills, production drilling machines, and special production machinery) in New York, as well as in Philadelphia, Pa., and New Haven, Conn.

OTTO G. SCHWENK has been appointed vice-president in charge of production of the Yale & Towne Mfg. Co., Chrysler Bldg., New York 17, N. Y. He was previously assistant to the president of the Weatherhead Co., Cleveland, Ohio.

WARD LEONARD ELECTRIC CO., Mount Vernon, N. Y., announces that its Rochester branch office, formerly located in the Lincoln Alliance Bank Bldg., has recently been moved to 66 South St., Rochester 7, N. Y.

A. R. ABEEL, SR., who sold his controlling interest in the Eastern Cutter Corporation, 30-32 Littleton Ave., Newark 7, N. J., in 1945 because of ill health, announces that having now fully recovered from his illness he has repurchased the corporation and will continue its original policies and services. Mr. Abeel will be president of the corporation—the position he previously held. The plant and assets of the LTS CUTTER CO., 91 Edison Place, Newark, N. J., have also been purchased by A. R. Abeel, Sr. CARL ABEEL, president of that company, will join the new organization, as well as A. R. ABEEL, JR., and MARION FLORIN.

Ohio

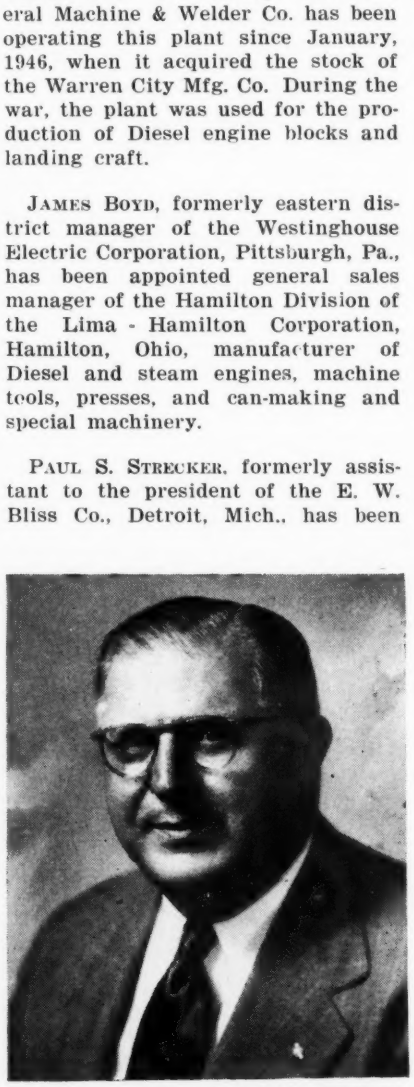
CYRIL BATH CO., Cleveland, Ohio, announces the acquisition of the Goodyear patents on Rotoforming in the United States, Canada, and England. During the war, the Goodyear Aircraft Co. and the Cyril Bath Co. developed machinery and methods for this process concurrently. Since the war, the Cyril Bath Co. developed further methods and machinery for more general application, and now operates a special division devoted to the manufacture of curved metal parts by the contour forming process.

BORG-WARNER CORPORATION, Chicago, Ill., announces that it has made plans for the erection of a $2,650,000 combined production plant and research laboratory on a 35-acre site adjacent to Cleveland, Ohio. The new plant will be used for the development and manufacture of high-precision aircraft parts. The factory will contain 219,000 square feet of floor space, and is expected to be completed by next May. Work has already been started on the laboratory building.

FEDERAL MACHINE & WELDER CO., Warren, Ohio, manufacturer of welding machines and all-welded steel presses, has purchased the plant and facilities of the WARREN CITY MFG. CO. from the U. S. Navy. The Federal Machine & Welder Co. has been operating this plant since January, 1946, when it acquired the stock of the Warren City Mfg. Co. During the war, the plant was used for the production of Diesel engine blocks and landing craft.

JAMES BOYD, formerly eastern district manager of the Westinghouse Electric Corporation, Pittsburgh, Pa., has been appointed general sales manager of the Hamilton Division of the Lima - Hamilton Corporation, Hamilton, Ohio, manufacturer of Diesel and steam engines, machine tools, presses, and can-making and special machinery.

PAUL S. STRECKER, formerly assistant to the president of the E. W. Bliss Co., Detroit, Mich., has been appointed works manager of the Toledo Machine & Tool Division of the company. R. E. HINDE, previously works manager, will act as assistant to the works manager, handling special assignments.



© John Henderson Studios

Paul S. Strecker, Recently Appointed Works Manager of Toledo Machine & Tool Division, E. W. Bliss Co.

M. O. SHEPHERD, who for many years was works manager of the Bunell Machine & Tool Co., Cleveland, Ohio, has purchased the LAECO, INC., factory at 15215 Chatfield Ave., Cleveland, for the manufacture of special machines and tooling. The name of the new company is SHEPHERD SPECIAL MACHINE & DIE CO. The officers are M. O. Shepherd, president; Dan E. Shepherd, vice-president; and Dick A. Shepherd, secretary.

CONDA P. BOGGS has been elected president of Victor Electric Products, Inc., Cincinnati, Ohio, a subsidiary of the W. L. Maxson Corporation of New York. Mr. Boggs resigned the position of vice-president of Sylvania Electric Products, Inc., to accept the new post.

GENE P. HOPKINS has been made general works manager of the Nelson Stud Welding Division of the Morton-Gregory Corporation, Lorain, Ohio. For the last two years he has served as assistant works manager of that division.

ALLEN-BRADLEY CO., Milwaukee, Wis., manufacturer of electric motor controls, announces the removal of its northern Ohio district office to 4312 Carnegie Ave., Cleveland 3, Ohio.

LORD MFG. CO., Erie, Pa., manufacturer of vibration-control mountings, announces the opening of a new office located at 238 Lafayette St., Dayton, Ohio, with W. W. DALTON in charge.

HOWARD A. BAUM has been appointed manager of office equipment sales for the Berger Manufacturing Division of the Republic Steel Corporation, Cleveland, Ohio.

Oklahoma and Colorado

GEOMETRIC TOOL CO., DIVISION GREENFIELD TAP & DIE CORPORATION, New Haven 15, Conn., manufacturer of screw-thread cutting machines and tools, announces the appointment of the MIDEKE SUPPLY CO., 109 E. Main St., Oklahoma City, Okla., as distributor for the company in the state of Oklahoma.

B. C. AMES CO., Waltham, Mass., has appointed the GEOFFROY CO., P.O. Box 67, Capitol Hill Station, Denver 6, Colo., exclusive agent in Colorado, Utah, and Wyoming for the Ames line of micrometer dial gages and indicators.

ONLY PHILLIPS RECESSED HEAD SCREWS

have Dimensional Uniformity assured by close ENGINEERING CONTROL

ESTABLISHED STANDARDS . . . Every manufacturer of Phillips Cross Recessed Head Screws is supplied with complete engineering and production data which prescribes precise dimensions and tolerances.
CENTRALIZED PRODUCTION TRAINING . . . And, before production is started on Phillips Screws, each plant's supervisory staff puts in an extended training period with Phillips engineers.
COMMON SOURCE OF RECESS FORMING TOOLS . . . Punches for forming the Phillips Cross Recess in all types and sizes of Phillips Screws are formed from master type at one plant. The manufacture of gauges for maintaining uniformity of Phillips Drivers and Bits are similarly centralized.
ENGINEERS' MEETINGS . . . Standards carefully established at the very beginning are rigorously maintained through meetings of "Phillips Recessed Head Standards Committee". Engineers from all plants meet to exchange ideas, discuss problems and learn about recent developments.

These elaborate precautions, this checking at every point and by every means makes sure you can depend on constant dimensional uniformity in Phillips Screws. They are *engineered* for PRACTICAL PRODUCTION . . . every screw and driver work together perfectly, in every size, every time. And this is just one of the five important reasons why only Phillips Cross Recessed Head Screws give you *all* the advantages of the cross recess design.

Get this new Fact-Full Booklet

that lets you in on the important facts you can't afford to overlook when you choose cross recessed head screws. It's FREE. Use the coupon.

GET ALL THE ADVANTAGES OF ASSEMBLY WITH CROSS RECESSED HEAD SCREWS . . .

GET PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

27 SOURCES

American Screw Co.
Camcar Products Co.
Central Screw Co.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
Elco Tool & Screw Corp.
The H. M. Harper Co.
Lamson & Sessions Co.
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Rockford Screw Products Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Seaboard Screw Corp.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Stronghold Screw Products, Inc.
Wales-Beech Corp.
Wolverine Bolt Company

Phillips Screw Mfrs.,
c/o Horton-Noyes Co.
1800 Industrial Trust Bldg.
Providence, R. I.

Send me the new booklet—"How to Select Recessed Head Screws for Practical Production Driving".

Name .....

Company .....

Address .....

M-34

(Left) Gilbert B. Richards, General Sales Manager of Firth Sterling Steel & Carbide Corporation. (Right) Lester B. Hamersley, New Sales Promotion Manager

Pennsylvania and North Carolina

GILBERT B. RICHARDS has been appointed general sales manager of the Firth Sterling Steel & Carbide Corporation, McKeesport, Pa. He was formerly general sales manager of Bostitch, Inc., Westerly, R. I. LESTER B. HAMERSLEY has been named sales promotion manager of the corporation. He was previously assistant sales manager of the Signode Steel Strapping Co., Chicago, Ill.

LEWIS W. METZGER, vice-president of the Baldwin Locomotive Works, Philadelphia, Pa., has been made executive assistant to Marvin W. Smith, executive vice - president. JAMES R. WEAVER has been appointed manager of manufacturing of the Eddystone Division, and JOHN S. NEWTON manager of engineering of that division. Both Mr. Weaver and Mr. Newton were previously connected with the Westinghouse Electric Corporation.

DR. LEWIS WARRINGTON CHUBB, director emeritus of the research laboratories of the Westinghouse Electric Corporation, Pittsburgh, Pa., has retired after forty-three years of association with the company, leaving behind him a record of outstanding contributions in nearly every field of science and engineering. He has been awarded more than 150 patents, covering inventions in radio, electronics, jet propulsion, telephony, electrical equipment, radar, and many other fields. Nearly every major engineering and scientific honor has been presented to Dr. Chubb.

A. C. MONTEITH has been elected vice-president in charge of engineering and research of the Westinghouse Electric Corporation, Pittsburgh, Pa., succeeding MARVIN W. SMITH, who was recently elected executive vice-president of the Baldwin Locomotive Works. Mr. Monteith has been connected with the Westinghouse organization for twenty-five years, starting as a graduate student engineer in the training course.

A. C. Monteith, Vice-president in Charge of Engineering and Research of Westinghouse Electric Corporation

Prior to his present appointment, he held the dual position of manager of headquarters engineering departments and director of education.

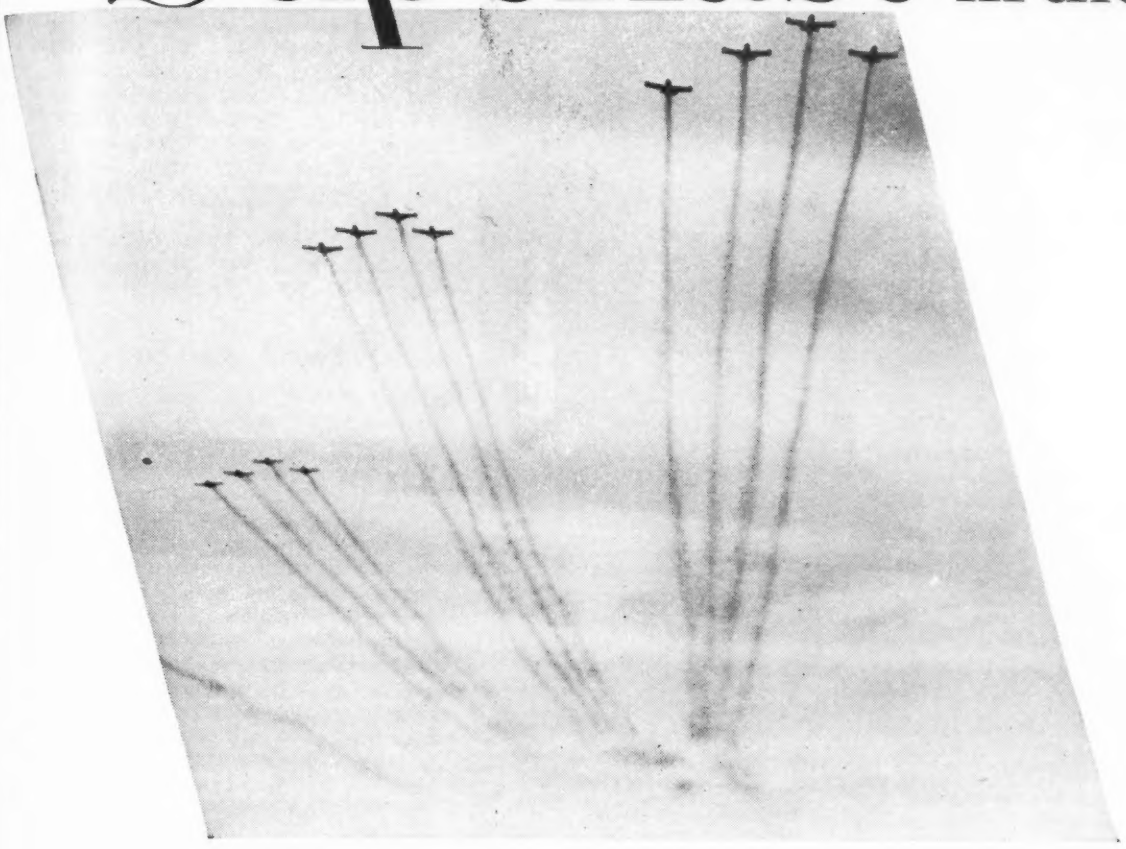
NICE BALL BEARING CO. is increasing the manufacturing facilities of its plant at 30th and Hunting Park Ave., Philadelphia 40, Pa. A separate office building is being constructed, and the vacating of the present office quarters will provide additional much needed factory space.

GISHOLT MACHINE CO., Madison, Wis., announces the opening of a new and larger branch office at 315 McClatchy Bldg., 69th and Market Sts., Upper Darby (Philadelphia) Pa. The company also announces that ERVIN A. HUZA has been added to the staff of this office.

W. W. SIEG, formerly executive vice-president of the Titan Metal Mfg. Co., Bellefonte, Pa., has been

(Left) James R. Weaver, Newly Appointed Manager of Manufacturing, Eddystone Division, Baldwin Locomotive Works. (Right) John S. Newton, Manager of Engineering, Eddystone Division

Superfast in the air...



but what about production?

An outstanding example of Bliss' pioneering in equipment for the aircraft industry is the patented 2500-ton Six Die Slide Press used by many aircraft builders to produce a variety of sheet metal parts. Dozens of dies are kept in constant operation, as 24 operators simply load and unload. Interlocked control of any slide sequence is provided. No master operator needed.

Planning for planes? Or for any giant production job? Then Bliss engineers can help. They'll dare to pioneer with you in designing power press equipment specially suited for the job at hand. They bring to every conference table a fund of *production* engineering knowledge that goes back over 90 years. They've designed and built more types and sizes of presses than any other company in the world.

Yes, if it's airplane wings or jet tail cones, gage parts or landing gear, Bliss is particularly qualified to bring to your pressed metal problem the development engineering experience that's needed to get the most out of production. That's why Bliss presses predominate throughout the pressed metal field, the aircraft, automotive, railroad, electrical, and many other industries... that's why the biggest presses for the toughest jobs have always been Bliss-built...that's why if yours is a tough one, you'll be on your way toward solving it by sending for a Bliss engineer today.

MARQUETTE · BLISS · CONSOLIDATED · TOLEDO ·
BLISS BUILT

E. W. BLISS COMPANY, DETROIT 2, MICHIGAN

WORKS AT: Toledo, Cleveland, Salem, Ohio; Hastings, Mich.; Englewood, N. J.; Derby, England; St. Ouen sur Seine, France.

BLISS BUILDS MORE TYPES AND SIZES OF PRESSES THAN ANY OTHER COMPANY IN THE WORLD

elected president, succeeding W. P. SIEG, who has been appointed vice-chairman of the board and chairman of the executive committee.

LEBANON STEEL FOUNDRY, Lebanon, Pa., has been named the American licensee for the Firth-Vickers centrifugal casting process, which will be employed in the production of turbo-jet engine parts required for the U. S. military aircraft engine program.

GUSTAVE R. GEIGER has been appointed supervisor of quality control for S K F Industries, Inc., Philadelphia, Pa., manufacturer of ball and roller bearings.

BARBER-COLMAN CO., Rockford, Ill., announces the appointment of PAUL WICHELHAUS, of the Apex Machine Tool Supply Co., 313 N. McDowell St., Charlotte, N. C., as exclusive distributor of Barber-Colman hobbing machines, hob-sharpening machines, hobs, cutters, and reamers in North and South Carolina.

Wisconsin

S. C. LAWSON, assistant general sales manager of Ampco Metal, Inc., Milwaukee, Wis., has been appointed general sales manager, succeeding R. J. THOMPSON, who has been transferred to California to serve as engineering and sales manager for the West Coast. J. P. HENRY will succeed Mr. Lawson as assistant general sales manager, and E. E. WHITSON, Philadelphia district manager, will assume the duties of advertising manager.

DIE-MOLD CORPORATION announces that it has moved into its new plant at 6619 Motor Ave., Milwaukee 13, Wis. The new factory provides increased floor space for the manufacture of dies, molds, and tools for the die-casting, permanent-mold casting, and plastic industries.

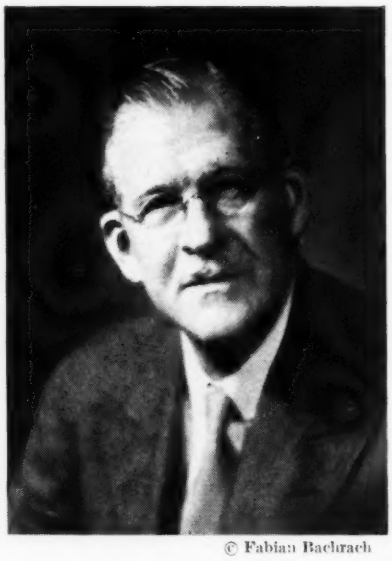
BJORKSTEN RESEARCH LABORATORIES has established a branch at 323 W. Gorham St., Madison, Wis.

* * *

Induction Heating Equipment Available on a Rental-Purchase Basis

The Induction Heating Corporation, 181 Wythe Ave., Brooklyn 11, N. Y., announces that it has made available to industry Ther-Monic induction and dielectric heating equipment on a rental-purchase plan. Under this arrangement, new or used induction or dielectric generators can be rented on a monthly basis, with the option to buy. This rental-purchase plan is believed to be unique in the heavy equipment field.

Obituaries



© Fabian Bachrach

Aldus C. Higgins

Aldus C. Higgins, for nearly a half century closely identified with the Norton Co., of Worcester, Mass., and long active in that city's cultural, philanthropic, and educational life, died on September 10 at his home in Worcester, aged seventy-five years.

Mr. Higgins, the son of Milton Prince Higgins—one of the founders of the Norton Co.—was born in Worcester on December 7, 1872. He was educated in the schools of that city, and received a Bachelor of Science Degree from Worcester Polytechnic Institute in 1893 and an Honorary Doctorate in Engineering in 1931. In addition to his engineering education, he also studied law at the National University Law School in Washington, D. C., and was awarded his LL.M. Degree in 1896. Leaving Washington that year, he returned to Worcester where he maintained a law office from 1896 to 1900.

Mr. Higgins was first employed by the Norton Co. as patent counsel, starting on July 1, 1900. He had served in many executive positions for the company, including that of president, general manager, and chairman of the board of directors, and at the time of his death was chairman of the executive committee. Always interested in the technical side of the manufacturing business, he invented the water-cooled electric furnace which made possible the commercial production of Alundum abrasive, and was awarded the John Scott Medal in 1913 by the Franklin Institute for this outstanding invention.

Mr. Higgins' activities were widespread. He was a member of the American Society of Mechanical Engineers and numerous other business, legal, and philanthropic organizations. Keenly interested in education, he took an outstanding part in promoting the trade school movement of this country. He was also a trustee of the Worcester Polytechnic Institute and of the Worcester Memorial Hospital. Mr. Higgins was widely known for his interest in art, and was president and a trustee of the Worcester Art Museum. On his seventy-fifth birthday, he was honored by the King of Sweden with the decoration of the Royal Swedish Order of Vasa, carrying the rank of Chevalier, for his outstanding contributions to industry and art.

He is survived by his wife and daughter and a son, Milton P. Higgins, president of the Norton Co.

Carl A. Carlson

Carl A. Carlson, sales engineer for the Norton Co., Worcester, Mass., died on August 29 in a plane crash near Winona, Minn. Mr. Carlson was born in Stockholm, Sweden, on June 19, 1888, and graduated from the Sala Engineering School in Sweden. He came to the United States in 1912 and became connected with the Norton Co. the following year, starting work in the machine shop. In 1920, Mr. Carlson was transferred to France to aid in the organization of the company's branch plant, erected that year near Paris. Returning to Worcester in 1922, he became affiliated with the Machine Division of the company. In 1923 he was transferred to the sales engineering department, where he remained from that time until his death. He was made sales engineer in charge of the rough grinding section in 1945.

Mr. Carlson made outstanding contributions to the company and to the metal-working industry in this country. He was the inventor of a billet grinding machine and a wire grinding machine, and also directed his company's activities in developing

Carl A. Carlson

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resinoid bonds for high-speed grinding in foundries and steel mills throughout the United States. Mr. Carlson was a leading consultant on snagging operations, and was considered one of the best informed men in this field in the world.

He was a member of the company's Sales Engineering Advisory Committee, and was a long-time member of the American Foundrymen's Society and the New England Foundrymen's Association.

B. C. Ames

Bliss Charles Ames, founder of the B. C. Ames Co., Waltham, Mass., died on August 18 at Newton, Mass., in his eighty-second year. Mr. Ames was born in Oxford, Maine, on May 19, 1867, and went to work at the age of eighteen for J. W. Penny & Sons, Mechanics Falls, Maine, where he learned the machinist's trade. Three years later, he obtained employment in the machine department of the Waltham Watch Co., and worked there for eleven years.

In 1898, Mr. Ames went into partnership with John Alcorn and engaged in precision tool work under the name of Alcorn & Ames. In 1901, he withdrew from the firm to establish the B. C. Ames Co. at Waltham, Mass., for the manufacture of bench lathes and dial gages. The business was incorporated in 1922, and the following year Mr. Ames sold his interest to his two sons, Warren and Ira R. Upon his retirement, he moved to California, where he lived until his wife died in 1947. At that time, Mr. Ames returned to Newton.

Emil R. Gasser

Emil R. Gasser, research director of the Farrel-Birmingham Co., Inc., died suddenly on September 5 at his home in Buffalo, N. Y. He was forty-four years of age. Mr. Gasser was first employed by the company in 1928, and for the last three years was director of research activities, with headquarters at the laboratory of the Buffalo plant. For his work in the development of propulsion gearing and related design during World War II, he was awarded a citation by the Navy Department.

Mr. Gasser was born in Switzerland. He was educated in the schools of Schaffhausen and Zurich, and came to the United States in 1925, locating in Buffalo.

He was a member of the Society of Automotive Engineers, the American Society of Naval Engineers, the Society of Naval Architects and Marine Engineers, and the American Gear Manufacturers Association. Since the end of the war he had served on a special research committee of the United States Navy. Mr. Gasser is survived by his wife and a son.

H. William Kopf

H. William Kopf, manager of the Detroit office of Pratt & Whitney, Division Niles-Bement-Pond Co., died suddenly on August 13 in Detroit, at the age of sixty-six years. Mr. Kopf had been intimately connected with

H. William Kopf

the machine tool business for forty-six years, and was widely known and liked throughout the industry. He first joined the Pratt & Whitney organization in New York in 1902. Later he completed a special two-year apprentice course in various shop capacities, preparatory to selling. In 1910, he went to the Detroit office of the company as a sales engineer, and in 1915 was made manager of that office.

JOSEPH H. HAZLEY, sales manager for many years of the Jacobs Mfg. Co., Hartford, Conn., died on August 4. Mr. Hazley had been connected with the company for more than twenty-five years in various official capacities. As sales manager, he was well known in industrial circles throughout the country. He was also a vice-president of the company at the time of his resignation from active service in 1945, and retained his membership on the board of directors until the time of his death.

ELMER E. WHITE, Milwaukee sales engineer for small tools and gages, Pratt & Whitney, Division Niles-Bement-Pond Co., died at his home in Milwaukee on July 21. He was fifty-two years old. Mr. White was born in Pasadena, Calif., and was a graduate of the Detroit Engineering College. He had represented Pratt & Whitney in the Milwaukee area since 1927. An active member of the American Society of Tool Engineers, Mr. White was widely known for his knowledge of cutting tools and precision gaging.

Coming Events

OCTOBER 11-13—Semi-annual convention of the AMERICAN SOCIETY OF TOOL ENGINEERS, in Los Angeles, Calif., with headquarters at the Biltmore Hotel. Executive Secretary Harry E. Conrad, 1666 Penobscot Bldg., Detroit 26, Mich.

OCTOBER 20-22 — Thirtieth annual meeting of the AMERICAN STANDARDS ASSOCIATION at the Waldorf-Astoria Hotel in New York. Secretary, G. F. Hussey, Jr., 70 E. 45th St., New York 17, N. Y.

OCTOBER 21-22—Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Statler Hotel in Cleveland, Ohio. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

OCTOBER 23-29—Annual convention of the AMERICAN SOCIETY FOR METALS at the Benjamin Franklin Hotel, Philadelphia, Pa. Secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 25-28—Annual meeting of the INSTITUTE OF METALS DIVISION, AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS at the Hotel Adelphia, Philadelphia, Pa. Division Secretary, Ernest Kirkendall, 29 W. 39th St., New York 18, N. Y.

OCTOBER 25-29 — Annual convention of the AMERICAN WELDING SOCIETY at the Bellevue-Stratford Hotel, Philadelphia, Pa. Secretary, M. M. Kelly, 33 W. 39th St., New York 18, N. Y.

OCTOBER 25-29 — Thirtieth annual National Metal Congress and Exposition sponsored by the AMERICAN SOCIETY FOR METALS; headquarters, Commercial Museum and Convention Halls, Philadelphia, Pa. National Secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

NOVEMBER 14-17—Annual meeting of the NATIONAL TOOL AND DIE MANUFACTURERS ASSOCIATION at the Hotel Schroeder in Milwaukee, Wis. Executive secretary, George S. Eaton, 1412 Union Commerce Bldg., Cleveland 14, Ohio.

NOVEMBER 28-DECEMBER 3 — Annual convention of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in New York City. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18.

NOVEMBER 29-DECEMBER 4 — EIGHTEENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING at the Grand Central Palace in New York. Chairman of the advisory committee, I. E. Moultrop, Grand Central Palace, New York 17, N. Y.

Design, Construction, Operation of Metal-Working Equipment and Manufacture of Metal Products

MACHINERY

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